

GUJARAT TECHNOLOGICAL UNIVERSITY
MCA INTEGRATED – SEMESTER - IV EXAMINATION- SUMMER-2023

Subject Code: 2648602**Date: 04/07/2023****Subject Name: Operations 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. List out the applications of OR. **07**

- (b)** A marketing manager has five salesman and five sales districts. Considering the capabilities of the salesman and the nature of the districts, the marketing manager estimates that the sales per month (in hundred rupees) for each district would be as follows: **07**

		Districts				
		A	B	C	D	E
Salesman	1	32	38	40	28	40
	2	40	24	28	21	36
	3	41	27	33	30	37
	4	22	38	41	36	36
	5	29	33	40	35	39

Find the assignments of salesman to districts that will result in maximum sales.

Q.2(a) Obtain the initial basic feasible solution for the following transportation problem by using the NWCM and LCM: **07**

		Retail Shops					
		R₁	R₂	R₃	R₄	R₅	Capacity
Factory	F₁	1	9	13	36	51	50
	F₂	24	12	16	20	1	100
	F₃	14	35	1	23	26	150
	Requirements	100	70	50	40	40	300

(b) Explain reasons for carrying Inventory in detail. **07**

OR

- (b) Use the Vogel's Approximation method (VAM) to find the initial basic feasible solution of the following transportation problem: 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

- Q.3(a) Explain Calling Population characteristics in context to Queuing System. 07

- (b) A company that operates for 50 weeks in a year is concerned about its stocks of copper cable. This costs RS 240 a meter and there is a demand for 8000 meters a week. Each replenishment costs Rs 1050 for administration and Rs 1650 for delivery, while holding costs are estimated at 25 % of the value held a year. Assuming no shortages are allowed, What is the optimal inventory policy for the company? 07

OR

- Q.3(a) Explain types of simulation in detail. 07

- (b) A company management and the labour union are negotiating a new three year settlement. Each of these has 4 strategies. 07

I: Hard and aggressive bargaining II: Reasoning and logical Approach
 III: Legalistic Strategy IV: Conciliatory approach
 The costs to the company are given for every pair of strategy choice.

Union Strategies	Company Strategies			
	I	II	III	IV
I	20	15	12	35
II	25	14	8	10
III	40	2	10	5
IV	-5	4	11	0

What strategy will the two sides adopt? Also determine the Value of the game.

- Q.4(a) Write a note on: 1) Events 2) Activities 07

- (b) The data collected in running a machine, the cost of which is Rs. 60,000, are given below: 07

Year:	1	2	3	4	5
Resale Value (Rs):	42,000	30,000	20,400	14,400	9,650
Cost of spares (Rs):	4,000	4,270	4,880	5,700	6,800
Cost of labour (Rs):	14,000	16,000	18,000	21,000	25,000

Determine the optimum period for replacement of the machine.

OR

- Q.4(a)** A manufacturing company processes 6 different jobs on two machines A and B. Number of units of each job and its processing time on A and B are given in the following table. Find the optimum sequence, the total minimum elapsed time and idle time for each machine. **07**

Job Number	No. of Units of Each Job	Processing Time (hours)	
		Machine A	Machine B
1	3	5	8
2	4	16	7
3	2	6	11
4	5	3	5
5	2	9	7.5
6	3	6	14

- (b)** Given the following table: **07**

Activity	A	B	C	D	E	F	G	H	I	J	K	L	M
Predecessor Activity	-	A	B	A	D	E	-	G	J, H	-	A	C, K	I, L
Duration (days)	6	4	7	2	4	10	2	10	6	13	9	3	5

Draw a network diagram, indicate the critical path for this project and for each non – critical activity, find the total and free float.

- Q.5(a)** List out the advantages and limitations of Linear Programming. **07**

- (b)** Obtain the dual problem of the following primal LP problem: **07**

$$\text{Minimize } Z_x = x_1 - 3x_2 - 2x_3$$

Subject to the constraints,

$$\text{i) } 3x_1 - x_2 + 2x_3 \leq 7 \quad \text{ii) } 2x_1 - 4x_2 \geq 12 \quad \text{iii) } -4x_1 + 3x_2 + 8x_3 = 10$$

and $x_1, x_2 \geq 0$; x_3 unrestricted in sign.

OR

- Q.5(a)** Use the simplex method to solve the following LP problem. **07**

$$\text{Maximize } Z_x = 3x_1 + 2x_2 + x_3$$

Subject to the constraints,

$$\text{i) } 2x_1 + 5x_2 + x_3 = 12 \quad \text{ii) } 3x_1 + 4x_2 = 11$$

and $x_2, x_3 \geq 0$; x_1 unrestricted in sign.

- (b)** Use the graphical method to solve the following LP problem. **07**

$$\text{Maximize } Z_x = 2x_1 + x_2$$

Subject to the constraints,

$$\text{i) } x_1 + 2x_2 \leq 10 \quad \text{ii) } x_1 + x_2 \leq 6 \quad \text{iii) } x_1 - x_2 \leq 2 \quad \text{iv) } x_1 - 2x_2 \leq 1$$

and $x_1, x_2 \geq 0$.
