

GUJARAT TECHNOLOGICAL UNIVERSITY
MCA – SEMESTER IV - EXAMINATION –SUMMER-2021

Subject Code: 2640003**Date: 05-08-2021****Subject Name: Operations Research (OR)****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.

- Q.1 (a)** What is Operations Research (OR)? Explain the Application of OR. **07**
- (b)** A person wants to decide the constituents of a diet which will fulfill his daily requirements of proteins, fats and carbohydrates at the minimum cost. The choice is to be made from four different types of foods. The yields per unit of these foods are given in the following table. Formulate linear programming model for the problem. **07**

Food Type	Yield per unit			Cost per unit
	Proteins	Fats	Carbohydrates	
1	3	2	6	45
2	4	2	4	40
3	8	7	7	85
4	6	5	4	65
Minimum Requirements	800	200	700	

- Q.2 (a)** Solve the following problem using graphical method: **07**
 Maximize $Z = 40x_1 + 100x_2$
 $2x_1 + x_2 \leq 500, 2x_1 + 5x_2 \leq 1000, 4x_1 + 6x_2 \leq 1800, x_1, x_2 \geq 0$
- (b)** Use simplex method to solve following problem: **07**
 Maximize $Z = 2x_1 + 5x_2$
 Subject to $x_1 + 4x_2 \leq 24, 3x_1 + x_2 \leq 21, x_1 + x_2 \leq 9, x_1, x_2 \geq 0$

OR

- (b)** Use Big-M Method to solve following problem: **07**
 Minimize $Z = 12x_1 + 20x_2$
 Subject to $3x_1 + 4x_2 \geq 50, 7x_1 + 12x_2 \geq 120, x_1, x_2 \geq 0$
- Q.3 (a)** Solve the following using least cost method and North West Corner Method. **07**

	P	Q	R	Supply
A	12	17	14	5
B	13	13	11	8
C	15	14	17	7
D	11	16	2	14
Demand	7	9	18	

(b) Solve the following assignment problem.

07

	P	Q	R	S	T
A	11	17	8	16	20
B	9	7	12	6	15
C	13	16	15	12	16
D	21	24	17	28	26
E	14	10	12	11	13

OR

Q.3 (a) Define: Two- person zero- sum game, Saddle point. For the game with payoff matrix:

07

Player A	Player B			
	B ₁	B ₂	B ₃	B ₄
A ₁	3	-5	0	6
A ₂	-4	-2	1	2
A ₃	5	4	2	3

Determine the best strategies for players A and B and the value of the game. Is this game (i) fair? (ii) strictly determinable?

(b) Find optimal solution of the following transportation problem.

07

	P	Q	R	S	Supply
A	20	18	17	22	500
B	22	23	16	20	600
C	18	20	22	24	900
Demand	700	550	450	300	

Q.4 (a) Explain the structure of queuing system in details.

07

(b) There are 7 jobs, each of which has to go through the machines A and B in the order AB. Processing times in hours are given as follow. Determine a sequence of these jobs that will minimize the total elapsed time T. Also find T and idle time for machines A and B.

07

Job	1	2	3	4	5	6	7
Machine A	3	12	15	6	10	11	9
Machine B	8	10	10	6	12	1	3

OR

Q.4 (a) What is simulation? Explain Monte-Carlo simulation along with all the necessary steps.

07

(b) Self-help canteen employs one cashier at its counter, 8 customer arrives every 10 minutes on an average. The cashier can serve at the rate of one customer per minute. Assume Poisson's distribution for arrival and exponential distribution for service patterns.

07

Determine:

(i) The average number of customers in the system.

(ii) The average queue length.

(iii) The average time customer spends in the system.

Q.5 (a) Explain the difference between PERT and CPM.

07

(b) The cost of a machine is Rs. 6100 and its scrap value is Rs. 100. The maintenance costs found as follows. When should the machine be replaced?

07

Year	1	2	3	4	5	6	7	8
Maintenance cost	100	250	400	600	900	1200	1600	2000

OR

Q.5 (a) A project has the following characteristics:

07

Activity	1-2	1-3	2-4	3-4	3-5	4-9	5-6	5-7	6-8	7-8	8-10	9-10
Time	4	1	1	1	6	5	4	8	1	2	5	7

- (1) Draw PERT Diagram.
- (2) Compute E and L for each event.
- (3) Find the critical path.

(b) A manufacturer has to supply his customer with 600 units of his product per year. Shortages are not allowed and the storage cost amounts to Rs 0.60 per unit per year. The set up cost per run is Rs 80.00. Find the Optimum run size and the minimum average yearly cost.

07
