

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-V(NEW) EXAMINATION – SUMMER 2022****Subject Code:3151910****Date:17/06/2022****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) Summarize applications of operation research. | 03 |
| | (b) Explain significance of positive, zero and negative opportunity cost with respect to transportation problem. | 04 |
| | (c) Solve graphically | 07 |
| | Maximize $Z = 10x_1 + 15x_2$
Subject to, $2x_1 + x_2 \leq 26$
$2x_1 + 4x_2 \leq 56$
$x_1 - x_2 \geq -5$
$x_1, x_2 \geq 0$ | |
| Q.2 | (a) Define slack and surplus variable with respect to linear programming problem | 03 |
| | (b) A person wants to invest up to 500000 in fixed securities scheme. Broker recommends two bonds: Bond A yielding 8% and bond B yielding 10%. He decide to invest at most 100000 in bond A and at least 200000 in bond B. he also wants the amount invested in bond A to be at least equal to amount invested in bond B. Formulate the problem | 04 |
| | (c) A simplex problem and its solution is given in table. | 07 |
| | (i) Formulate dual to the given problem
(ii) Verify the objective function value for both the primal and dual using value given in table | |

Maximize $Z = x_1 + 1/2 x_2$
 Subjects to $6x_1 + 2x_2 \geq 24$
 $3x_1 + 2x_2 \geq 18$
 $x_1 + 3x_2 \geq 12$ and $x_1, x_2 \geq 0$

Basis	x1	x2	S1	S2	S3	A1	A2	A3	bi
x1	1	0	-1/3	1/3	0	1/3	-1/3	0	2
S3	0	0	7/6	-8/3	1	-7/6	8/3	-1	8
x2	1/2	1	1/2	-1	1	-1/2	1	0	6
cj	1	1/2	0	0	0	M	M	M	
solution	2	6	0	0	8	0	0	0	
Δj	0	0	1/12	1/6	0	M-1/12	M-1/6	M	

OR

- (c) Solve the following LPP using Simplex method **07**
- Maximize: $Z = 2x_1 + 4x_2$
 Subject to $2x_1 + x_2 \leq 18$
 $3x_1 + 2x_2 \geq 30$
 $x_1 + 2x_2 = 26$ and
 $x_1, x_2 \geq 0$

- Q.3 (a)** How profit maximization problem can be solved in assignment technique? **03**
- (b)** Amul milk has three plant A, B & C with daily milk processing capacity (in Mega Liter) as 11, 6 & 5 and requirement at distribution center P, Q, R & S are 8, 4, 7 & 3 Mega liter respectively. Unit transportation cost is given in the table. Find the initial feasible solution using N-W corner method. **04**

Unit transportation cost (Rs. in 1000/ Mega Litre)				
	P	Q	R	S
A	2	5	3	8
B	4	1	6	4
C	7	5	8	2

- (c)** To repair four road of city five contractor bid the tender (amount in lakhs). **07**
Using assignment techniques find...
1 optimum cost of road repairing?
2 Which contractor will be unable to get contract?

		Road			
		A	B	C	D
contractor	P	9	14	19	25
	Q	7	17	20	19
	R	9	18	21	18
	S	10	12	18	19
	T	10	15	21	16

OR

- Q.3 (a)** Explain degeneracy in transportation problem. **03**
- (b)** Is given solution of assignment problem is correct as per the criterion of travelling salesman problem? If not, then modified it. **04**

	I	II	III	IV	V
I	M	5	15	30	0
II	20	M	0	30	0
III	20	15	M	0	15
IV	40	0	5	M	5
V	0	10	0	35	M

- (c)** Find the optimum solution for the following transportation table. **07**

	W1	W2	W3	W4	Capacity
F1	19	30	50	10	7
F2	70	30	40	60	9
F3	40	8	70	20	18
Requirement	5	8	7	14	

- Q.4 (a)** Explain 'zero-sum' in the context of game theory. **03**

- (b) Bikes arrives at fuel pump in poisons fashion with an average of 9 bikes per 5 minutes. service boy can refuel 10 bikes in 5 minutes. Find... **04**
1. Average number of bikes in a system. And in queue.
 2. Average time a bike spends in system.
 3. Average time a bike waits before being served.

- (c) Running cost and resale value of bike whose purchase price is ₹ 60,000, given in the table, find the age of replacement. **07**

Year	1	2	3	4	5	6	7
Resale value	30000	15000	7500	3750	2000	2000	2000
Running cost	10000	12000	14000	18000	23000	28000	34000

OR

- Q.4** (a) Define a) Balking b) Jockeying c) Reneging with respect to queueing **03**
- (b) Discuss group replacement policy with suitable example. **04**
- (c) In a game of matching coins with two players, player A wins ₹1 when there are two heads, wins nothing when there are two tails and loose ₹1/2 when one head and one tail. Determine the payoff matrix, strategies and value of game. **07**

- Q.5** (a) Explain predecessor, successor and dummy activity with diagram. **03**
- (b) Jyoti CNC introduce three model of CNC machine, which can lead to increase, neutral and decrease in sales. Sales department workout the payoff in terms of yearly net profit for each type of sales action as tabulated below. **04**

Machine types	Estimated net profit (In Crores)		
	Increase	Neutral	Decrease
Model 1	60	30	30
Model 2	30	40	30
Model 3	15	10	25

help to take decision using Maximax and Laplace criterion.

- (c) Draw a network corresponding to following tabular information and calculate early and latest start & finish time also determine critical path. **07**

Activity	1-2	1-3	2-6	3-4	3-5	4-6	5-6	5-7	6-7
Duration	4	6	8	7	4	6	5	19	10

OR

- Q.5** (a) Discuss the difference between decision-making under certainty, under uncertainty and under risk. **03**
- (b) Differentiate PERT and CPM **04**
- (c) Tasks A to I constitutes a project in which the precedence relationships are A < D; A < E; B < F; D < F; C < G; C < H, F < I; G < I. **07**

Time in day for each task is as follows:

Task	A	B	C	D	E	F	G	H	I
Time	8	10	8	10	16	17	18	14	9

Draw the network to represent the project and find out total float of each activity and identify critical path
