

GUJARAT TECHNOLOGICAL UNIVERSITY**BE – SEMESTER- V EXAMINATION-SUMMER 2023****Subject Code: 3151910****Date: 01/07/2023****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) Define OR. Discuss the origin and development of OR. | 03 |
| (b) Discuss Various phases in solving an OR problems. | 04 |
| (c) Explain the Scope of OR in the various sectors. | 07 |
| Q.2 (a) What are the applications of LPP? | 03 |
| (b) Define. | 04 |
| I. Basic Feasible Solution | |
| II. Objective Function | |
| III. Degenerate Solution | |
| IV. Optimal Feasible Solution | |
| (c) Solve the following LPP by Simplex Method. | 07 |
| Maximize $Z = 70x_1 + 150x_2$ | |
| Subject to $4x_1 + 6x_2 \leq 84$ | |
| $0.5x_1 + x_2 \leq 60$ and $x_1, x_2 \geq 0$ | |
| OR | |
| (c) Find dual of the following LPP: | 07 |
| Minimize $Z = 5x_1 - 6x_2 + 4x_3$ | |
| Subject to $3x_1 + 4x_2 + 6x_3 \geq 9$ | |
| $x_1 + 3x_2 + 2x_3 \geq 5$ | |
| $7x_1 - 2x_2 - x_3 \leq 10$ and $x_1, x_2, x_3 \geq 0$ | |
| Q.3 (a) How will you define transportation problem? Give mathematical statement of problem explaining each term. | 03 |
| (b) Discuss various methods of getting IBFS in transportation problem. | 04 |
| (c) Find out optimal solution for following transportation problem. | 07 |

	1	2	3	4	5	6	Supply
A	9	12	9	6	9	10	50
B	7	3	7	7	5	5	60
C	6	5	9	11	3	11	20
D	6	8	11	2	2	10	90
Demand	40	40	60	20	40	20	220

OR

- Q.3 (a)** Define. **03**
I. Discount Rate
II. Money Value
III. Present worth factor
- (b)** Discuss about the individual replacement versus group replacement. **04**
- (c)** A printer costing RS. 6500 initially has maintenance & resale value as given below: **07**

Year (n)	1	2	3	4	5	6	7
Resale Value (s)	3000	2500	2000	1500	1000	700	500
Maintenance cost F (t)	100	250	500	1000	1500	1800	2000

- Q.4 (a)** A postman has to visit four societies of an area. He does not want to visit any society twice before completing the visit of all societies from starting one. Following is the matrix showing distance (in kms) of his journey. Suggest him such that his constraint is fulfilled as well as it takes least time. **07**

	I	II	III	IV
I	-	0.420	0.920	0.620
II	0.520	-	1.520	0.420
III	0.520	0.620	-	0.320
IV	0.820	0.920	1.420	-

- (b)** Solve the following assignment problem for assigning jobs to workers. **07**

		Jobs			
		A	B	C	D
Workers	1	50	70	110	60
	2	80	50	90	60
	3	40	70	100	70
	4	100	40	80	30

OR

- Q.4 (a)** Define the elements of Queuing system. **03**
- (b)** Explain Kendal's notation for Queuing system. **04**
- (c)** At barber's shop, the customers arrive at the average interval of 6 minutes, and the barber takes on an average 5 minutes for serving the person. Calculate: **07**
- Counter utilization level
 - Average number of customers in the including at service system
 - Average number of customers in the queue
 - Average waiting time of customers in the system
 - Expected average waiting time in the queue

- Q.5 (a)** Write down mathematical formula for game theory. **03**
- (b)** What are types of strategies for game theory? **04**
- (c)** Solve the following pay-off matrix for player A. Also find out the optimal strategies and value of the game using algebraic method. **07**

		Player B		
		B1	B2	B3
Player A	A1	275	-50	-75
	A2	125	130	150

OR

- Q.5 (a)** Define. **03**
- I. Event
 - II. Activity
 - III. Total float with respect to CPM/PERT
- (b)** Explain term “Crashing of network”. Why it is required? **04**
- (c)** The activities A to H for a new project having relationships and timings shown in table below. **07**

Relation between Activities

A<C, D B<E C<F D<F E, F<H

1. Draw the network.
2. Find the critical path & expected time of completion of the project.
3. What will be the standard deviation of the project completion duration?
4. What will be the probability of completing the project in expected time of completion?

Duration (in days)

Activity	to	tm	tp
A	2	2	8
B	2	5	8
C	3	6	15
D	2	5	14
E	1	1	7
F	2	2	8
G	2	2	8
H	2	5	14
