Seat No.: _____   Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–V (NEW) EXAMINATION – WINTER 2022

Subject Code:3151910   **Date:19-01-2023**
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. Simple and non-programmable scientific calculators are allowed.

			MARKS

Q.1 **(a)** State and explain various characteristics of Linear Programming.   **03**
      (b) Write the general mathematical formulation of a LP Problem.   **04**
      (c) Find the maximum value of $Z = 20 X_1 + 10 X_2$ by graphical method; **07**
      Subject to: $X_1 + 2 X_2 \leq 40$
                         $3X_1 + X_2 \geq 30$
                         $4X_1 + 3X_2 \geq 60$ Where, $X_1, X_2 \geq 0$.

Q.2 **(a)** Briefly explain 'Decision Tree'.   **03**
      (b) Discuss the difference between decision-making under certainty and under **04**
            conflict.
      (c) Describe the computational procedure of Two-phase method.   **07**
                                    OR
      (c) Solve the following problem by simplex method;   **07**
            Maximize; $Z = 3X_1 + 2X_2 + 5X_3$
            Subject to: $X_1 + 2X_2 + X_3 \leq 430$
                               $3X_1 + 2X_3 \leq 460$
                               $X_1 + 4X_2 \leq 420$.   Where, $X_1, X_2 \geq 0$.

Q.3 **(a)** Briefly explain about unbalanced assignment problems.   **03**
      (b) Describe the procedure to solve travelling salesman problem.   **04**
      (c) Solve the following transportation problem. Obtain the initial basic feasible **07**
            solution by Vogel's method and optimal solution by MODI method.

	M_1	M_2	M_3	M_4	Supply
F_1	3	2	4	1	20
F_2	2	4	5	3	15
F_3	3	5	2	6	25
F_4	4	3	1	4	40
Demand	30	20	25	25	

                                    OR
Q.3 **(a)** Explain: Transportation problems with prohibited routes.   **03**
      (b) What are trans-shipment problems? Explain with suitable example.   **04**
      (c) Solve the following assignment problem.   **07**

	Jobs		
Workers	A	B	C
1	110	140	60
2	80	100	110
3	90	120	70
4	100	130	80

Q.4 **(a)** Explain the queuing model as indicated by the following notations. **03**
M/D/1 : FCFS/∞/∞

(b) Define: Queue and give its classification. Mention applications of each type **04**
of queue.

(c) Solve the following 4 X 4 game using rule of dominance. **07**

Player B

		I	II	III	IV
	I	3	5	4	2
Player A	**II**	5	6	2	4
	III	2	1	4	0
	IV	3	3	5	2

OR

Q.4 **(a)** List the different methods for solving Game Problems. **03**
(b) Write the important assumptions of "Game Theory". **04**
(c) Vehicles arrive at a toll-booth at a rate of 8 per minute. The serving capacity **07**
of operator at toll-booth is 10 vehicles per minute. Find out (i) utilization
factor (ii) idle time for booth operator in an 8 hour shift (iii) number of
vehicles waiting in the system (iv) number of persons waiting in the queue
(v) average waiting time in the queue and (vi) total time spent by a vehicle
in the system.

Q.5 **(a)** Define event, activity and dangling with respect to project management. **03**
(b) Explain D.R. Fulkerson's rule for network diagram. **04**
(c) A vehicle having initial cost of Rs. 50,000 has the following data based on **07**
past experience:

Year	1	2	3	4	5	6	7
Maintenance cost in Rs.	5,000	6,000	7,000	9,000	11,500	16,000	18,000
Resale value in Rs.	30,000	15,000	7,500	3,750	2,000	2,000	2,000

Calculate replacement time of the vehicle.

OR

Q.5 **(a)** Describe some important replacement situations. **03**
(b) Differentiate between CPM and PERT. **04**
(c) Determine the critical path for given project schedule and find out total float **07**
for each event.

Activity	Time (weeks)	Activity	Time (weeks)
1-2	10	4-6	9
1-3	6	4-8	8
1-4	7	5-7	7
2-5	3	6-7	15
2-6	3	7-9	4
3-8	12	8-9	6

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