

GUJARAT TECHNOLOGICAL UNIVERSITY**BE- SEMESTER-V (NEW) EXAMINATION – WINTER 2024****Subject Code:3152008****Date:28-11-2024****Subject Name:Production Optimization Techniques****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) Write the limitations of Operation Research. | 03 |
| (b) Discuss the role of Operation Research in business. | 04 |
| (c) Use the graphical method to solve the following LP problem, | 07 |

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

$$\text{Subject to } x_1 + 2x_2 \leq 10$$

$$x_1 + x_2 \leq 6$$

$$x_1 - x_2 \leq 2$$

$$x_1 - 2x_2 \leq 1$$

$$\text{And } x_1, x_2 \geq 0$$

- | | |
|--|-----------|
| Q.2 (a) Write the requirements of LPP. | 03 |
| (b) List out various applications of LPP. | 04 |
| (c) Discuss the stepwise procedure to solve linear programming problem with simplex method. | 07 |

OR

- | | |
|--|-----------|
| (c) Solve the following LP problem by the Simplex method. | 07 |
|--|-----------|

$$\text{Maximize } Z = 4x_1 + 3x_2$$

$$\text{Subject to } 2x_1 + x_2 \leq 1000$$

$$x_1 + x_2 \leq 800$$

$$x_1 \leq 400$$

$$x_2 \leq 700$$

$$\text{And } x_1, x_2 \geq 0$$

- | | |
|--|-----------|
| Q.3 (a) Define the slack and surplus variable. | 03 |
| (b) A Manufacturer wants to ship 8 loads of his product as shown in following matrix. The matrix gives the mileage from origins, O to the destinations, D. The shipping cost is Rs. 10 per load per mile. What will be the optimal schedule and optimal cost? Use Vogel's approximation method to find initial basis feasible solution. | 04 |

	D ₁	D ₂	D ₃	Supply
O ₁	50	30	220	1
O ₂	90	45	170	3
O ₃	250	200	50	4
Demand	4	2	2	

- (c) Obtain the optimal solution using MODI method for the transportation problem shown in above Q. 3(b). **07**

OR

- Q.3** (a) Under which conditions optimality test can be performed in transportation problem? **03**
- (b) Discuss degeneracy in transportation model. **04**
- (c) Consider the assignment problem shown in table below. In the problem 5 different jobs are to be assigned to 5 different operators such that the total processing time is minimized. The matrix entries represent processing times in hours. Solve with the Hungarian method. **07**

	1	2	3	4	5
1	20	24	30	24	16
2	14	32	28	28	22
3	26	28	14	18	18
4	24	20	22	26	20
5	16	26	30	22	30

- Q.4** (a) Define the Non-Square matrix in assignment problem. **03**
- (b) Explain the procedure for constructing a decision tree for arriving at the best decision out of the various options. **04**
- (c) A small project is composed of 7 activities whose time estimates are listed in the table below. Activities are identified by their beginning (i) and ending (j) node numbers **07**

Activity	Estimated duration (weeks)		
(i-j)	Optimistic	Most likely	Pessimistic
1-2	1	1	7
1-3	1	4	7
1-4	2	2	8
2-5	1	1	1
3-5	2	5	14
4-6	2	5	8
5-6	3	6	15

- i.) Draw the network diagram of activities in the project
- ii.) Find the expected duration and variance of each activity.
- iii.) What is the expected project length?
- iv.) Calculate the variance and standard deviation of the project length.

OR

- Q.4** (a) Define Total float, Independent float and Free float. **03**
- (b) Differentiate the PERT and CPM. **04**

- (c) The details of activity in project management are given below. 07

Activity	Normal		Crash	
	Time (Days)	Cost (Rs.)	Time (Days)	Cost (Rs.)
1-2	3	300	2	400
2-3	6	480	4	520
2-4	7	2100	5	2500
2-5	8	400	6	600
3-4	4	320	3	360
4-5	5	500	4	520

Find (i) Critical path & Project duration, (ii) Optimum project cost with considering indirect cost is Rs. 100 per day.

- Q.5 (a) Write the assumptions for Johnson's rule. 03
 (b) Give the various example of sequencing problem from your daily life. 04
 (c) Discuss the process of n jobs and m machines for the sequencing problem. 07

OR

- Q.5 (a) Clarify the need for a dummy activity in a network diagram. 03
 (b) Compare the transportation and assignment model. 04
 (c) Discuss the concept of decision tree in detail. 07
