**R18**

**Code No: 155CQ**

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**

**B. Tech III Year I Semester Examinations, March - 2024**

**OPERATIONS RESEARCH**

**(Mechanical Engineering)**

**Time: 3 Hours** **Max. Marks: 75**

**Note:** i) Question paper consists of Part A, Part B.
ii) Part A is compulsory, which carries 25 marks. In Part A, Answer all questions.
iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

**PART – A**

**(25 Marks)**

| | | |
|---|---|---|
| 1.a) | Classify models according to the technique used for solving them. | [2] |
| b) | State the differences between Big M method and two phase method for solving LPP. | [3] |
| c) | Define Degeneracy. | [2] |
| d) | List out variants of assignment problem and how are they resolved. | [3] |
| e) | State the difference between flow shop problem and Job shop problem. | [2] |
| f) | State the Group replacement policy. | [3] |
| g) | Distinguish terms between pure strategy and mixed strategy. | [2] |
| h) | Derive the expression for EOQ when demand is uniform, production rate is infinite and shortages are not allowed. | [3] |
| i) | What is M/M/C:N/FIFO queue? | [2] |
| j) | Explain the terms associated with dynamic programming. | [3] |

**PART – B**

**(50 Marks)**

| | | |
|---|---|---|
| 2.a) | Define model and classify and explain models with respect various criterion. | |
| b) | List out and briefly explain various applications of Operations Research. | [5+5] |

**OR**

| | | |
|---|---|---|
| 3. | Solve the following LPP problem by Big M method. | [10] |

Max = $2x_1 + 3x_2 + 5x_3$ St

$3x_1 + 10x_2 + 5x_3 \leq 15$

$33x_1 - 10x_2 + 9x_3 \leq 33$

$x_1 + 2x_2 + 3x_3 \geq 4$

4. Solve the following transportation problem by finding initial basic feasible solution by Vogels method and findings optimal solution. [10]

| Warehouse / Factory | W | X | Y | Z | Availability |
|---|---|---|---|---|---|
| A | 19 | 30 | 50 | 10 | 7 |
| B | 70 | 30 | 40 | 60 | 9 |
| C | 40 | 8 | 70 | 20 | 18 |
| Requirement | 5 | 8 | 7 | 14 | |

**OR**

5. A Company has one surplus truck in each of the cities A, B, C, D and E and one deficit truck in each of the cities 1, 2, 3, 4, 5 and 6. The distance between the cities in kilometers is shown in the matrix below (table). Find the assignment of trucks from cities in surplus to cities in deficit so that the total distance covered by vehicles is Minimum. [10]

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| A | 12 | 10 | 15 | 22 | 18 | 8 |
| B | 10 | 18 | 25 | 15 | 16 | 12 |
| C | 11 | 10 | 3 | 8 | 5 | 9 |
| D | 6 | 14 | 10 | 13 | 13 | 12 |
| E | 8 | 12 | 11 | 7 | 13 | 10 |

6. The time spent in hours in processing two jobs on six machines A, B, C, D, E and F and the necessary technological orderings of machines are as follows.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Job 1: | A | 20 | C | 10 | D | 10 | B | 30 | E | 25 | F | 15 |
| Job 2: | A | 10 | C | 30 | B | 15 | D | 10 | F | 15 | E | 20 |

Use graphic method to determine an optimal sequence of jobs which minimizes the elapsed time. [10]

**OR**

7. The following failure rates have been observed for a certain type of light bulbs:

| End of week | Probability of failure to date |
|---|---|
| 1 | 0.05 |
| 2 | 0.13 |
| 3 | 0.25 |
| 4 | 0.43 |
| 5 | 0.68 |
| 6 | 0.88 |
| 7 | 0.96 |
| 8 | 1.00 |

The cost of replacing an individual failed bulb is Rs.1.25. The decision is made to replace all bulbs simultaneously at fixed intervals and also to replace individual bulbs as they fall in service. If the cost of group replacement is 30 paise per bulb, what is the best interval between group replacement? At what group replacement price per bulb would a policy of strictly individual replacement become preferable to the adopted policy? [10]

8. A and B play a game in which each has three coins: 5 paisa, 10 paisa and 20 paisa. Each selects a coin without the knowledge of other's choice. If the coin is odd amount. A wins B's coin and if the sum is even B win A's coin. Find the best strategy for each player and value of the game. [10]

**OR**

9. Find the optimal ordering quantity for a product for which the price breaks are given below:

| Quantity | Price(Rs.) |
|---|---|
| $0 \le Q_1 < 500$ | 10 |
| $500 \le Q_2 < 750$ | 9.25 |
| $750 \le Q_3$ | 8.75 |

The monthly demand for the product is 200 units. Storage cost is 2% of the unit cost per month and the cost of ordering is Rs.200 per order. [10]

10. In a railway yard goods train arrive at a rate of 30 trains/day. Assuming that the inter-arrival time follows an exponential distribution and service time distribution is also exponential with an average 36 minutes. Calculate the following:
a) The average number of trains in the queue.
b) The average waiting of a train in the system.
c) The probability that the number of trains in the system exceeds 10. [10]

**OR**

11. A company has to transport some goods from city A to city J. The cost of transportation between the different cities is given in the following network. Find the optimal route connecting cities A and J. [10]

| | B | C |
|---|---|---|
| A | 5 | 4 |

| | D | E | F |
|---|---|---|---|
| B | 4 | 3 | - |
| C | - | 2 | 6 |

| | G | H | I |
|---|---|---|---|
| D | 3 | 6 | - |
| E | 5 | 7 | 8 |
| F | - | 9 | 9 |

| | J |
|---|---|
| G | 7 |
| H | 3 |
| I | 8 |

---ooOoo---