

6. Trains arrive at the yard every 15 minutes and the service time is 33 minutes. If the line capacity of the yard is limited to 4 trains, find : **20**

- (a) The probability that the yard is empty  
(b) The average number of trains in the system.

#### Unit IV

7. Solve the following all integer programming problem using Branch and Bound technique

$$\text{Max. } Z = 3x_1 + 5x_2$$

Subject to constraints

$$2x_1 + 4x_2 \leq 25$$

$$x_1 \leq 8$$

$$2x_2 \leq 10$$

and  $x_1, x_2 \geq 0$  and integer. **20**

No. of Printed Pages : 05

Roll No. ....

**DD-318**

**M. Sc. EXAMINATION, Dec. 2017**

(Fourth Semester)

(Re-appear Only)

Mathematics

MAT-618-B

Operation Research

*Time : 3 Hours]*

*[Maximum Marks : 100*

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Before answering the question-paper candidates should ensure that they have been supplied to correct and complete question-paper. No complaint, in this regard, will be entertained after the examination.

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**Note :** Attempt *Five* questions in all, selecting at least *one* question from each Unit. All questions carry equal marks.

### Unit I

1. Using Penalty (Big-M) method, solve the following L.P.P. : **20**

$$\text{Max. } z = x_1 + 3x_2 - 2x_3$$

Subject to

$$-x_1 - 2x_2 - 2x_3 = -6$$

$$-x_1 - x_2 + x_3 \leq -2$$

$$x_1, x_2, x_3 \geq 0$$

2. Using Dual Simplex Method, solve the given L.P.P. : **20**

$$\text{Min. } Z = x_1 + 2x_2 + 3x_3$$

Subject to

$$2x_1 - x_2 + x_3 \leq 4$$

$$x_1 + x_2 + 2x_3 \leq 8$$

$$x_2 - x_3 \geq 2$$

$$x_1, x_2, x_3 \geq 0$$

### Unit II

3. Solve the following assignment problem : **20**

|   | I  | II | III | IV | V  |
|---|----|----|-----|----|----|
| A | 9  | 11 | 15  | 10 | 11 |
| B | 12 | 9  | —   | 10 | 9  |
| C | —  | 11 | 14  | 11 | 7  |
| D | 14 | 8  | 12  | 7  | 8  |

4. Solve the following transportation problem to maximize profit and give criteria for optimality : **20**

| Origin | Profit |    |    |    | Supply |
|--------|--------|----|----|----|--------|
|        | 1      | 2  | 3  | 4  |        |
| A      | 40     | 25 | 22 | 33 | 100    |
| B      | 44     | 35 | 30 | 30 | 30     |
| C      | 38     | 38 | 28 | 30 | 70     |
| Demand | 40     | 20 | 60 | 30 |        |

### Unit III

5. A company uses Rs. 10,000 worth of an item during the year. The ordering costs are Rs. 25 per order and carrying charges are 12.5% of the average inventory value. Find the economic order quantity, number of order per year, time period per order and the total cost. **20**

8. Solve the following non-linear programming problem :

$$\text{Max. } z = 7x_1^2 + 6x_1 + 5x_2^2$$

Subject to

$$x_1 + 2x_2 + \leq 10$$

$$x_1 - 3x_2 \leq 9$$

$$x_1, x_2 \geq 0$$

8. Solve the following non-linear programming problem :

$$\text{Max. } z = 7x_1^2 + 6x_1 + 5x_2^2$$

Subject to

$$x_1 + 2x_2 + \leq 10$$

$$x_1 - 3x_2 \leq 9$$

$$x_1, x_2 \geq 0$$