(3 Hours) (Marks: 80)

N.B. : (1) Answer any four questions out of the six questions.
(2) Figures to the right indicate full marks.
(3) Illustrate answers with neat sketches where ever required.
(4) Answers to the questions should be grouped and written together.
(5) Assume suitable data if required.

1. (a) Consider the problem for Graphical Method 10

Min. $Z = -X_1 + 2X_2$
Subject to,
$-X_1 + 3X_2 \leq 10$
$X_1 + X_2 \leq 6$
$X_1 - X_2 \leq 2$
$X_1 X_2 \geq 0$

(b) Discuss the advantages and limitations of simulation 10

2. (a) Solve by Big M method 10

Minimize z $20X_1 + 10X_2$
Subject to
$X_1 + X_2 \leq 40$
$4X_1 + 3X_2 \geq 60$
$3X_1 + X_2 \geq 30$
$X_1, X_2 \geq 0$

(b) The annual demand of a product made by a company is 10,000units to a certain stockiest. The cost of placing an order is Rs.300. The item costs Rs.20 per piece and the inventory cost per unit is 20% of the item cost. The storage cost is given as Rs.25/unit/year. Compute: 10

i. Economic Order Quantity
ii. Total Cost of keeping the inventory
iii. Maximum inventory that can be held.

3. (a) Solve the following problem by Dual simplex method 10

Min.$Z = X_1 + X_2$
$2X_1 + X_2 \geq 2$
$-X_1 - X_2 \geq 1$
$X_1, X_2 \geq 0$

(b) Explain in detail the structure of queuing system describing each element of queue with suitable example. 10

4. (a) Determine the optimum basic feasible solution to the following transportation problem. Find basic feasible solution by Vogel's Approximation Method and optimum solution by "uv " method. 10

| | | To | | | |
|---|---|---|---|---|---|
| | | A | B | C | Available |
| From | I | 50 | 30 | 220 | 1 |
| | II | 90 | 45 | 170 | 3 |
| | III | 250 | 200 | 50 | 4 |
| | | 4 | 2 | 2 | |

(b) Solve the following Assignment problem for minimization 10

| | I | II | III | IV | V |
|---|---|---|---|---|---|
| 1 | 11 | 17 | 8 | 16 | 20 |
| 2 | 9 | 7 | 12 | 6 | 15 |
| 3 | 13 | 16 | 15 | 12 | 16 |
| 4 | 21 | 24 | 17 | 28 | 26 |
| 5 | 14 | 10 | 12 | 11 | 13 |

5. (a) Use two phase simplex method to solve following problem 10

Maximize $Z = 5 X_1 + 3 X_2$

Subject to the constraints $2X1 + X_2 \leq 1$

$X_1 + 4 X_2 \geq 6$

$X_1, X_2 \geq 0$

(b) Provide the optimum job sequencing involving three machines $M_1$, $M_2$ and $M_3$ (order $M_1$, $M_2$ $M_3$ ) for the following: 10

| Job | | J1 | J2 | J3 | J4 | J5 |
|---|---|---|---|---|---|---|
| Time on Machines | $M_1$ | 7 | 12 | 11 | 9 | 8 |
| | $M_2$ | 8 | 9 | 5 | 6 | 7 |
| | $M_3$ | 11 | 13 | 9 | 10 | 14 |

6. (a) **1.** Consider the LPP and solve by Simplex method 10

Maximize $Z = 4X_1 + 3X2 + 6 X_3$

Subject to

$2X_1 + 3X_2 + 2 X_3 \leq 440$

$4X_1 + 32X_3 \leq 470$

$2X_1 + 5X_2 \leq 430$

$X_1, X_2, X_3 \geq 0$

(b) The profit for three markets as a function of sales effort expended, as given in the table. How will you distribute a given number of salesmen, so as to achieve maximum profit? 10

| No. of salesmen | Markets | | |
|---|---|---|---|
| | I | II | III |
| 0 | 40 | 50 | 50 |
| 1 | 42 | 60 | 60 |
| 2 | 50 | 65 | 70 |
| 3 | 60 | 75 | 80 |
| 4 | 66 | 85 | 88 |
| 5 | 75 | 95 | 105 |
| 6 | 82 | 110 | 115 |
| 7 | 90 | 120 | 130 |

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