## Sixth Semester B.E. Degree Examination, Jan./Feb. 2021
## Operations Research

Time: 3 hrs.                                                                 Max. Marks:100

**Note:** *Answer any FIVE full questions, selecting at least TWO full questions from each part.*

### PART – A

1   a.   Define Operations Research. Briefly explain the phases of Operations Research.   **(08 Marks)**
    b.   Solve the following LPP by graphical method:
         Minimize $Z = 20x_1 + 10x_2$
         Subject to $x_1 + 2x_2 \leq 40$
         $3x_1 + x_2 \geq 30$
         $4x_1 + 3x_2 \geq 60$  and
         $x_1 \geq 0, x_2 \geq 0$                                                       **(06 Marks)**
    c.   The following table gives data for a Linear Programming Problem where the objective is to maximize the profit from allocating 3 resources to 2 non negative activities. Formulate the LPP model for this problem.                                               **(06 Marks)**

| Resource | Resource Requirement/unit | | Availability |
|----------|------------|------------|--------------|
|          | Activity 1 | Activity 2 |              |
| 1        | 2          | 1          | 10           |
| 2        | 3          | 3          | 20           |
| 3        | 2          | 4          | 20           |
| Profit/unit | 20      | 30         |              |

2   a.   Explain the special cases that arise in the use of simplex method.              **(10 Marks)**
    b.   Solve the following LPP using simplex method in tabular form.
         Maximize $Z = x + 1.5y$
         Subject to $x + 2y \leq 160$
         $3x + 2y \leq 240$ and
         $x \geq 0, y \geq 0$                                                            **(10 Marks)**

3   a.   Explain two phase technique to solve LPP in simplex method.                     **(06 Marks)**
    b.   Use Big-M method to solve the following LPP
         Maximize $Z = 2x_1 + x_2$
         Subject to  $3x_1 + x_2 = 3$
         $4x_1 + 3x_2 \geq 6$
         $x_1 + 2x_2 \leq 3$                                                             **(14 Marks)**

**4** a. Explain the computational procedure of revised simplex method in standard form. **(10 Marks)**

b. Explain the relation between the solution of the primal and the dual. **(06 Marks)**

c. Find the dual of the following problems:

   i) Maximize $Z = x_1 + 2x_2 + x_3$

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

   $-2x_1 + x_2 - 5x_3 \geq -6$

   $4x_1 + x_2 + x_3 \leq 6$

   $x_1, x_2, x_3 \geq 0$

   ii) Maximize $Z = 6x_1 + 10x_2$

   Subject to $x_1 \leq 14$

   $x_2 \leq 16$

   $3x_1 + 2x_2 \leq 18$

   $x_1, x_2 \geq 0$
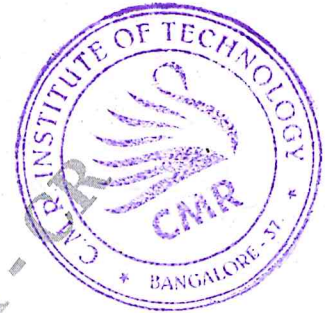
**(04 Marks)**

## PART – B

**5** a. Write the procedure for sensitivity analysis. **(08 Marks)**

b. Use dual simplex method to solve the following:

   Maximize $Z = -2x_1 - 3x_2$

   Subject to $x_1 + x_2 \geq 2$

   $2x_1 + x_2 \leq 10$

   $x_1 + x_2 \leq 8$

   $x_1 \geq 0 \quad x_2 \geq 0$

**(12 Marks)**

**6** a. Write different steps in Hungarian Algorithm to solve an assignment problem. **(08 Marks)**

b. Obtain optimal solution of transportation problem using the data given below. Use Vogel's approximation method to obtain an initial basic feasible solution. **(12 Marks)**

|        | $D_1$ | $D_2$ | $D_3$ | $D_4$ | Supply |
|--------|-------|-------|-------|-------|--------|
| $S_1$  | 19    | 30    | 50    | 10    | 7      |
| $S_2$  | 70    | 30    | 40    | 60    | 9      |
| $S_3$  | 40    | 8     | 70    | 20    | 18     |
| Demand | 5     | 8     | 7     | 14    | 34     |

**7** a. Solve the game whose pay off matrix is given below:

Player B

Player A
| 3 | 2 | 4 | 0 |
|---|---|---|---|
| 3 | 4 | 2 | 4 |
| 4 | 2 | 4 | 0 |
| 0 | 4 | 0 | 8 |

**(10 Marks)**

b. Use graphical method to solve the following game:

Player B

| Player A | A | $B_1$ | $B_2$ | $B_3$ | $B_4$ |
|----------|---|-------|-------|-------|-------|
|          | $A_1$ | 2 | 2 | 3 | -2 |
|          | $A_2$ | 4 | 3 | 2 | 6 |

**(10 Marks)**

**8** a. Explain genetic algorithm and simulate annealing algorithm. **(12 Marks)**

b. Explain in detail the minimum spanning free with constraints. **(08 Marks)**

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