**NRT/KS/19/2228**

**Bachelor of Computer Application (BCA) Semester—III Examination**

**OPERATIONS RESEARCH—I**

**Paper—IV**

Time : Three Hours]                                                                                    [Maximum Marks : 50

**Note :—** (1) All questions are compulsory and carry equal marks.

   (2) Draw neat and labelled diagrams wherever necessary.

   (3) Assume suitable data wherever necessary.

   **EITHER**

1. (a) Define OR. Explain its scope and limitations.                                                5

   (b) Formulate the model to maximize the profit.

| Machine type | Machine time required for products (minutes) | | Max time available per week (minutes) |
|---|---|---|---|
| | P1 | P2 | |
| Lathe | 4 | 9 | 2000 |
| Milling | 12 | 5 | 5000 |
| Grinding | 6 | 10 | 900 |
| Profit/Unit | Rs. 40 | Rs. 60 | |

5

   **OR**

   (c) Explain phases of OR.                                                                        5

   (d) Find the status of the following LPP graphically :—

   Max $Z = 6x_1 + x_2$

   subject to

   $2x_1 + x_2 \geq 3$

   $-x_1 + x_2 \geq 0$

   $x_1 \geq 0, \ x_2 \geq 0.$                                                                      5

   **EITHER**

2. (a) Explain Simplex Algorithm.                                                                   5

   (b) Show that there is an unbounded solution to LPP.

   Maximize $Z = 4x_1 + x_2 + 3x_3 + 5x_4$

   subject to the constraints

   $-4x_1 + 6x_2 + 5x_3 + 4x_4 \leq 20$

   $3x_1 - 2x_2 + 4x_3 + x_4 \leq 10$

   $8x_1 - 3x_2 + 3x_3 + 2x_4 \leq 20$

   $x_1, x_2, x_3, x_4 \geq 0.$                                                                     5

   **OR**

   (c) Write the steps to solve LPP using two-phase method.                                         5

   (d) Solve the given LPP using Simplex method :

   Maximize $Z = 3x_1 + 2x_2$

   subject to the constraints

   $2x_1 + x_2 \leq 6$

   $3x_1 + 4x_2 \leq 12$

   $x_1, \ x_2 \geq 0.$                                                                             5

CLS—13437                                                      1                                                      (Contd.)

**EITHER**

3. (a) Explain North-West corner method for Transportation problem.    5

   (b) Solve the transportation problem using Vogel's approximation method :

|  | D1 | D2 | D3 | D4 | Supply |
|---|---|---|---|---|---|
| P1 | 2 | 3 | 11 | 7 | 6 |
| P2 | 1 | 0 | 6 | 1 | 1 |
| P3 | 5 | 8 | 15 | 9 | 10 |
| Demand | 7 | 5 | 3 | 2 | |

5

**OR**

   (c) Explain Vogel's approximation method for transportation problem.    5

   (d) Solve the transportation problem using least cost method :

|  | D1 | D2 | D3 | D4 | Supply |
|---|---|---|---|---|---|
| S1 | 11 | 13 | 17 | 14 | 250 |
| S2 | 16 | 18 | 14 | 10 | 300 |
| S3 | 21 | 24 | 13 | 10 | 400 |
| Demand | 200 | 225 | 275 | 250 | |

5

**EITHER**

4. (a) Explain Hungarian Method, to solve an assignment problem.    5

   (b) Find the optimal solution to the given assignment problem :

|  | C1 | C2 | C3 | C4 |
|---|---|---|---|---|
| R1 | 86 | 11 | 22 | 42 |
| R2 | 76 | 91 | 12 | 32 |
| R3 | 50 | 66 | 82 | 31 |
| R4 | 24 | 40 | 50 | 11 |

5

**OR**

   (c) Explain Branch and Bound method for transportation problem.    5

   (d) Find the optimal solution to assignment problem using Hungarian method :

|  | M1 | M2 | M3 | M4 |
|---|---|---|---|---|
| J1 | 5 | 7 | 11 | 6 |
| J2 | 8 | 5 | 9 | 6 |
| J3 | 4 | 7 | 10 | 7 |
| J4 | 10 | 4 | 8 | 3 |

5

5. (a) Give the classification of problems in OR.    2½

   (b) Define slack variable, surplus variable and artificial variable.    2½

   (c) What do you mean by unbalanced transportation problem ? How will you balance it ?    2½

   (d) Give the mathematical formulation of an assignment problem.    2½