QP Code: R253G072 | Reg. No | | | | | | | | | | | AY 24

**Gandhi Institute of Engineering and Technology University, Odisha, Gunupur**

**(GIET UNIVERSITY)**

M.Sc. (Third Semester – Regular) Examinations, December – 2025

**24MPCMA23005 – Optimization Techniques**

(Mathematics)

Time: 3 hrs | Maximum: 60 Marks

**Answer ALL questions**

**(The figures in the right hand margin indicate marks)**

**PART – A** **(2 x 5 = 10 Marks)**

| Q.1. Answer ***ALL*** questions | | CO # | Blooms Level |
|---|---|---|---|
| a. | A paper mill produces two grades of paper namely X and Y. Owing to raw material restrictions, it cannot produce more than 400 tons of grade X and 300 tons of grade Y in a week. There are 160 production hours in a week. It requires 0.2 and 0.4 hours to produce a ton of products X and Y, respectively with corresponding profits of ₹200 and ₹500 per ton. Formulate the above as an LPP to maximize profit and find the optimum product mix. | CO4 | K2 |
| b. | Define slack and surplus variable. | CO3 | K1 |
| c. | What are the advantages and disadvantages of Branch and Bound methods? | CO6 | K1 |
| d. | Write down the steps of North-West Corner rule. | CO4 | K1 |
| e. | Define nonlinear programming problem with an example? | CO3 | K1 |

**PART – B** **(10 x 5 = 50 Marks)**

| Answer ***ALL*** the questions | | Marks | CO # | Blooms Level |
|---|---|---|---|---|
| 2. a. | Solve the following LPP by graphical method.<br>Minimize $Z = 20x_1 + 10x_2$<br>Subject to, $x_1 + 2x_2 \leq 40$<br>$3x_1 + x_2 \geq 30$<br>$4x_1 + 3x_2 \geq 60$<br>$x_1, x_2 \geq 0$ | 5 | CO1 | K3 |
| b. | Write down the simplex method algorithm. | 5 | CO1 | K1 |
| | (OR) | | | |
| c. | Use simplex method Solve the LPP.<br>Max $Z = 3x_1 + 2x_2$<br>Subject to, $x_1 + x_2 \leq 4$<br>$x_1 - x_2 \leq 2$<br>$x_1, x_2 \geq 0$ | 10 | Co4 | K3 |
| | (OR) | | | |
| b. | Using branch and bound method to solve the following LPP,<br>$Max\ z = 7x_1 + 9x_2$<br>$subject\ to\ constraints,\ \ 3x_1 + 2x_2 \leq 5$<br>$-x_1 + 3x_2 \leq 6$<br>$7x_1 + x_2 \leq 35$<br>$x_1, x_2 \geq 0\ and\ are\ integers$ | 10 | Co5 | K3 |

4.a. Write the difference between Transportation and Assignment problem. 5 Co3 K2

b. Define the mathematical formulation of an Assignment problem. 5 Co4 K1

(OR)

c. Find the initial basic feasible solution for the following transportation problem by Vogel's approximation method. 10 Co6 K2

| Destination | | | | | | |
|---|---|---|---|---|---|---|
| Origin | | $D_1$ | $D_2$ | $D_3$ | $D_4$ | Supply |
| | $O_1$ | 11 | 13 | 17 | 14 | 250 |
| | $O_2$ | 16 | 18 | 14 | 10 | 300 |
| | $O_3$ | 21 | 24 | 13 | 10 | 400 |
| | Demand | 200 | 225 | 275 | 250 | 950 |

5.a. In a game of matching coins with two players, suppose a wins one unit of value when there are two heads, wins nothing when there are two tails and losses $\frac{1}{2}$ unit of value when there are one head and one tail. Determine the pay-off matrix, the best strategy for each player and the value of game to the A. 5 Co3 K2

b. Solve the following $2 \times 3$ games graphically, 5 Co2 K2

Player B

Player A $\begin{bmatrix} 1 & 3 & 11 \\ 8 & 5 & 2 \end{bmatrix}$

(OR)

c. Using the principal of dominance, solve the following game: 10 Co5 K3

Player B

Player A $\begin{bmatrix} 3 & -2 & 4 \\ -1 & 4 & 2 \\ 2 & 2 & 6 \end{bmatrix}$

6.a. Apply Wolfe's method to solve QPP. 10 Co1 K3

Maximize $Z=2x_1 + 3x_2 - 2x_1^2$

subject to , $x_1 + 4x_2 \leq 4$

$x_1 + x_2 \leq 2$

$x_1, x_2 \geq 0$

(OR)

b. Solve the following NLP using Kuhn-Tucker condition. 10 Co1 K3

Maximize $Z= x_1^2 - x_1x_2 - 2x_2^2$

Subject to, $4x_1 + 2x_2 \leq 24$

$5x_1 + 10x_2 \leq 20$

$x_1, x_2 \geq 0$

--- End of Paper ---