Roll No:_____

24/3/2018

DOON UNIVERSITY, DEHRADUN
Department of Mathematics, School of Physical Sciences
Mid Semester Examination, Even Semester 2017-18

Class : Int.M.Sc.Mathematics | **Semester : VI**

Course: Linear Programming | **Course Code: MAD-353**

Time Allowed : 2 Hours | **Max Marks : 30**

Note: Attempt all **Four** questions in Section A. Each question carries **1.5** marks.
Attempt any **Three** questions in Section B. Each question carries **4** marks.
Attempt any **Two** questions in Section C. Each question carries **6** marks.

Section: A
(Very Short Answer Type Questions)

Attempt all Four questions. **[4×1.5 = 6 Marks]**

1. Describe the following terms (i) Basic feasible solution (ii) Convex hull (iii) Hyperplane.
2. Examine the convexity of the set $S = \{(x_1, x_2) : x_1 \leq 2, x_2 \leq 3, x_1 \geq 0, x_2 \geq 0\}$.
3. Write the dual of the linear programming problem(LPP):
   Maximize $Z = 2x_1 + 3x_2 + 4x_3$
   Subject to: $2x_1 + 2x_2 + 3x_3 \leq 4$; $3x_1 + 4x_2 + 5x_3 \geq 5$; $x_1 + x_2 + x_3 = 7$, $x_1, x_2, x_3 \geq 0$.
4. Prove that dual of the dual is primal.

Section B
(Short Answer Type Questions)

Attempt any Three questions. **[3×4 = 12 Marks]**

5. Prove that a set S is convex iff every convex linear combination of points in S belongs to S.
6. Prove that in a LPP if the optimum of $f(X)$ occurs at an interior point X_0 of S_F, then $f(X)$ is constant throughout S_F(set of feasible solutions).
7. Use Graphical method for solving the following LPP:
   Maximize $Z = 5x_1 + 3x_2$
   Subject to: $4x_1 + 5x_2 \leq 10$; $5x_1 + 2x_2 \leq 10$; $3x_1 + 8x_2 \leq 12$; $x_1, x_2 \geq 0$.
8. Use Simplex method to solving the following LPP:
   Maximize $Z = 2x_1 + 5x_2 + 7x_3$
   Subject to: $3x_1 + 2x_2 + 4x_3 \leq 100$; $x_1 + 4x_2 + 2x_3 \leq 100$; $x_1 + x_2 + 3x_3 \leq 100$; $x_1, x_2, x_3 \geq 0$.

Section C
(Long Answer Type Questions)

Attempt any Two questions. **[2×6 = 12 Marks]**

9. Prove that a vertex of $S_F \iff$ a basic feasible solution(B.F.S.).
10. Solve the following LPP using Two-Phase method:
    Minimize $Z = x_1 + x_2 + x_3$
    Subject to: $x_1 - 3x_2 + 4x_3 = 5$; $x_1 - 2x_2 \leq 3$; $2x_2 + x_3 \geq 4$; $x_1, x_2 \geq 0$ and x_3 is unrestricted.
11. Solve the following LPP using Big-M method:
    Maximize $Z = x_1 + 2x_2 + 3x_3 - x_4$
    Subject to: $x_1 + 2x_2 + 3x - 3 = 15$; $2x_1 + x_2 + 5x_3 = 20$; $x_1 + 2x_2 + x_3 + x_4 = 10$; $x_1, x_2, x_3, x_4 \geq 0$.