First Semester Model Question Paper (C.B.C.S.) Examination
Complementary Course I – (OPERATIONS RESEARCH)-Linear programming
(For B.Sc. Mathematics Model II Programme)

Time: Three Hours                                                                                           Maximum: 80 Marks

Part A
Brief answer questions. Answer any ten questions. Each question carries 2 marks.

1. Find the inner product of the vector [2,3, 4]' and [4, 2,3]' 
2. State Cauchy-Schwarz inequality in En.
3. Give a vector linearly independent to [1, 2]' in E2.
4. What are orthogonal vectors?
5. What is the euclidean norm of the vector [2,3, 4]’
6. Give an example of a set which is neither closed nor open.
7. What is the convex hull of the set S = {X1;X2}
8. Define local minima and maxima
9. Give an example of a convex programming problem.
10. Define basic feasible solutions
11. Define a Linear Programming problem
12. What do you mean by Degeneracy in LPP

(10X2 = 20)

Part B
Short Essay type questions. Answer any six questions. Each question carries 5 marks.

13. Determine whether the vector [6,1,-6,2] is in the vector space generated by the vectors. 
   [1,1,-1,1],[-1,0,1,1],[1,-1,-1,0]
14. Find the inner product of the vectors [2,-3,4] and [4,-2,-3]
15. Determine whether the following matrix is positive definite or not. 
   \[
   \begin{bmatrix}
   1 & 2 & 2 \\
   2 & 4 & 8 \\
   2 & 8 & 4 
   \end{bmatrix}
   \]
16. Determine whether the form \( x_1^2+2x_2^2-2x_3^2-2x_1x_2-x_2x_3 \) is positive definite or not.
17. Define
   (a) General Mathematical programming Problem
   (b) Convex Programming Problem
18. Solve graphically
   Maximize $4x_1 + 2x_2$ subject to $x_1 + x_2 \leq 4$, $x_1 = 4$, $x_1 \geq 0$, $x_2 \geq 0$

19. Illustrate the relation between the set of all feasible solutions and vertices of $S_F$

20. Maximize $x_1 + 2x_2 \text{subject to } x_1 + 3x_2 \leq 4$, $x_1 \leq 4$, $x_1 \geq 0$, $x_2 \geq 0$ using simplex algorithm.

21. Minimize $2x_1, x_2 \text{subject to } x_1 + x_2 \leq 4$, $x_2 \geq 4$, $x_1 \geq 0$, $x_2 \geq 0$ using Big M Method.

   (6 x 5 = 30)

**Part C**

**Essay Type questions. Answer any two questions. Each question carries 15 marks.**

22. Explain the different methods to find a symmetric matrix is positive definite or not.

23. Maximize $5x_1 + 3x_2 + x_3 \text{subject to } 2x_1 + x_2 + x_3 \leq 3$, $x_1 \leq 4$, $x_1 \geq 0$, $x_2 \geq 0$ using simplex algorithm.

24. Solve Two Phase Simplex method:
   Maximize $x_1 + x_2 \text{subject to } 7x_1 - 6x_2 \leq 5$, $6x_1 + 3x_2 \geq 7$, $-3x_1 + 8x_2 \leq 6$, $x_1 \geq 0$, $x_2 \geq 0$

25. Solve graphically
   Minimize $-5x_1, 3x_2 \text{subject to } x_1 + x_2 \leq 2$, $5x_1 + 2x_2 \leq 10$, $3x_1 + 8x_2 \leq 12$, $x_1 \geq 0$, $x_2 \geq 0$

   (15 x 2 = 30)