

**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  $E_n$ .
3. Give a vector linearly independent to  $[1, 2]'$  in  $E_2$ .
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  $S = \{X_1;X_2\}$
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  $x_1 + 2x_2$  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  $2x_1 - x_2$  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  $5x_1 + 3x_2 + x_3$  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  $x_1 + x_2$  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  $-5x_1 - 3x_2$  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)