



QP CODE: 23104768

Reg No :

Name :

**B.Sc DEGREE (CBCS) REGULAR/IMPROVEMENT/REAPPEARANCE
EXAMINATIONS, FEBRUARY 2023**

First Semester

B.Sc Mathematics Model II Computer Science

**Complementary Course - MM1CMT02 - MATHEMATICS - OPERATIONS RESEARCH
- LINEAR PROGRAMMING**

2017 Admission Onwards

2FCAC5DE

Time: 3 Hours

Max. Marks : 80

Part A

*Answer any **ten** questions.*

*Each question carries **2** marks.*

1. Define the term linear combination of vectors.
2. Define a subspace of a vector space.
3. Define δ - neighbourhood of a point.
4. Define a closed set.
5. Define a convex set.
6. Define the term convex polyhedron.
7. True or false: Every polytope has a vertex. Justify your answer with an example.
8. Define local minima of a function $f(X)$
9. Define a concave function.
10. Define a basic solution.
11. Define the term basic feasible solution.
12. Explain Slack variable in a linear programming problem.

(10×2=20)



Part B

Answer any **six** questions.

Each question carries **5** marks.

13. Determine whether $X = [0 \ 1 \ 1]$ is a linear combination of $X = [0 \ 1 \ 1]$ and $X_2 = [1 \ 1 \ 1]$.
14. Solve the following system of homogeneous equations:

$$4x + y + 2z = 0 - 3x + 2y + 4z = 0 \quad 8x - y - 2z = 0$$
15. Indicate the following form is positive definite or negative definite

$$x_1^2 - 2x_2^2 + x_3^2$$
16. Explain a Mathematical programming Problem and a Convex programming Problem.
17. Prove that sum of two convex functions is a convex function
18. Write the following LP problem in standard form
 Maximize $f(X) = 2x_1 + x_2 - x_3$
 Subject to

$$2x_1 - 5x_2 + 3x_3 \leq 43 \quad x_1 + 6x_2 - x_3 \geq 2 \quad x_1 + x_2 + x_3 = 3 \quad x_1 \geq 0, x_3 \geq 0, x_2 \text{ unrestricted}$$
19. Solve graphically
 Maximize $3x_1 - 2x_2$
 subject to $x_1 + x_2 \leq 1, \quad 2x_1 + 2x_2 \geq 4, \quad x_1, x_2 \geq 0$
20. Solve by simplex method
 Maximize $f = 5x_1 + 3x_2$
 Subject to

$$4x_1 + 5x_2 \leq 105 \quad x_1 + 2x_2 \leq 103 \quad x_1 + 8x_2 \leq 12 \quad x_1 \geq 0, x_2 \geq 0$$
21. Use simplex method to solve
 Maximize $f = 4x_1 + 3x_2 + 4x_3 + 6x_4$
 Subject to

$$x_1 + 2x_2 + 2x_3 + 4x_4 \leq 80 \quad 2x_1 + 2x_3 + x_4 \leq 60 \quad 3x_1 + 2x_2 + x_3 + x_4 \leq 80 \quad x_1, x_2, x_3, x_4 \geq 0$$

(6×5=30)

Part C



Answer any **two** questions.

Each question carries **15** marks.

22. Prove that $f(X) = 2x_1^2 + 2x_2^2 + 4x_3^2 + 2x_1x_2 + 2x_1x_3 + 4x_2x_3$ is a convex function.

23. Solve graphically

Maximize $f = 3x_1 + 4x_2$

Subject to

$$4x_1 + 3x_2 \geq 12, x_1 + 2x_2 \leq 2, x_1 \geq 0, x_2 \geq 0$$

24. Solve by two phase simplex method

Maximize $f = 4x_1 + 5x_2$

Subject to

$$x_1 - 2x_2 \leq 2, 2x_1 + x_2 \leq 6, -x_1 + x_2 \leq 5, x_1 + x_2 \geq 1, x_1 \geq 0, x_2 \geq 0$$

25. Solve

Maximize $f = 3x_1 + 4x_2$

Subject to

$$4x_1 + 3x_2 \geq 12, x_1 + 2x_2 \leq 2, x_1 \geq 0, x_2 \geq 0$$

(2×15=30)