QP CODE: 25047279

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M.Sc DEGREE (CSS) EXAMINATION, NOVEMBER 2025

Third Semester

M Sc MATHEMATICS

Core Course - ME010305 - OPTIMIZATION TECHNIQUE

2019 ADMISSION ONWARDS

D2C7CE92

Time: 3 Hours Weightage: 30

Part A (Short Answer Questions)

*Answer any **eight** questions.*

*Weight **1** each.*

1. What do you mean by degeneracy in LP Problems?
2. Write the dual of the following LP problem and verify that the dual of the dual is primal.
   Minimize $f(X) = 12x_1 + 9x_2$, Subject to $2x_1 - x_2 \leq 5, 3x_1 + 5x_2 \geq 9; x_1, x_2 \geq 0$.
3. Define mixed integer vector and hence define MILPP.
4. Explain Knapsack Problem and its mathematical model.
5. Define the following with suitable example.
   (i) Graph (ii) Partial graph (iii) Centre of a graph
6. Explain the term spanning tree with example.
7. Write short note on scheduling sequential activity.
8. If $f(x) = x^2 - 5x + 4$, (1) calculate the value of this function at x = 3 and (2) find the value of f(x) at x=6 by using (1) and derivatives of f(x).
9. Write short note about perturbation vector.
10. Write down the Lagrange function and K-T conditions of NLP
    Minimize $f(x) = -6x_1 + 2x_1^2 - 2x_1x_2 - 2x_2^2$ subject to $x_1 + x_2 \leq 2, x_2 \leq 8; x_1, x_2 \geq 0$.

(8×1=8 weightage)

Part B (Short Essay/Problems)

*Answer any **six** questions.*

*Weight **2** each.*

11. Derive the canonical form of equations and using this canonical form, eliminate the basic variables from the corresponding objective function.

12. Prove that the value of the objective function $f(X)$ for any feasible solution of the primal is not less than the value of the objective function $\varphi(Y)$ for any feasible solution of the dual.

13. *Solve graphically: Max* $f(X) = 6x_1 + 5x_2$ *subject to*
$x_1 - 3x_2 \leq 7, 3x_1 + 4x_2 \leq 12, 5x_1 + x_2 \leq 5, x_1 \geq 0, x_2 \geq 0.$

14. Explain the Branch and Bound Method for solving ILPP.

15. Explain Goal Programming.
A factory can manufacture two products A and B. The profit on a unit of A is Rs. 80 and of B is Rs. 40. The maximum demand of A is 6 units per week and B is 8 units per week. This manufacturer has set a goal of achieving a profit of Rs. 640 per week. Formulate the problem as goal programming and solve it.

16. State and prove maximum flow minimum cut theorem.

17. Express the function $7x_1^2 + 10x_2^2 + 7x_3^2 - 4x_1x_2 + 2x_1x_3 - 4x_2x_3$ in the form $X'QX$. Is it convex or not?

18. Maximize $f(X) = 3x_1^2 + x_2^2 + 2x_1x_2 + 6x_1 + 2x_2$ subject $2x_1 - x_2 = 4$

(6×2=12 weightage)

Part C (Essay Type Questions)

*Answer any **two** questions.*

*Weight **5** each.*

19. Solve the following LPP using simplex method
Maximize $f(X) = 4x_1 + 5x_2$
Subject to $x_1 - 2x_2 \leq 2, 2x_1 + x_2 \leq 6, x_1 + 2x_2 \leq 5, -x_1 + x_2 \leq 2, x_1 \geq 0, x_2 \geq 0$

20. *By introducing suitable cuts, solve the ILPP* $z = 9x_1 + 10x_2$ *subject to*
$0 \leq x_1 \leq 10, 0 \leq x_2 \leq 8, 3x_1 + 5x_2 \geq 45,$ for x_1 and x_2 *are integers.*

21. Find the minimum path from v_1 to v_8.

Arc	(1,2)	(1,3)	(1,4)	(2,3)	(2,6)	(2,5)	(3,5)	(3,4)
Length	-1	4	-11	2	8	7	-3	7
Arc	(4,7)	(5,6)	(5,8)	(6,3)	(6,7)	(6,8)	(7,3)	(7,8)
Length	3	1	12	4	4	-10	-2	2

22. Maximize the function $f(n) = \begin{cases} x/2 & \text{if } n \leq 2 \\ -x + 3 & \text{if } n > 2 \end{cases}$ in the interval (0,3) by Fibonacci method using N = 6 and $\epsilon = 0.5$.

(2×5=10 weightage)