QP CODE: 25022252

25022252

Reg No : .....

Name : .....

M.Sc DEGREE (CSS) SPECIAL REAPPEARANCE EXAMINATION, APRIL 2025

Third Semester

CORE - ME010305 - OPTIMIZATION TECHNIQUE

M.Sc MATHEMATICS , M.Sc MATHEMATICS (SF)

2019 ADMISSION ONWARDS

2515062B

Time: 3 Hours Weightage: 30

Part A (Short Answer Questions)

*Answer any **eight** questions.*

*Weight **1** each.*

1. 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 $2x_1 - x_2 \leq 5, 3x_1 + 5x_2 \geq 9; x_1, x_2 \geq 0$.
2. To find the optimum value of a primal problem, it is enough to find the optimum value of its dual. Isn't true? Justify.
3. *Define related LP problem and Associated LP problem with respect to an ILPP.*
4. *What you meant be Either Or constraint.*
5. Define the following with suitable example.
   (i) Graph (ii) Cycle (iii) Arborescence
6. Explain minimum path problem.
7. Write short note on scheduling sequential activity.
8. What you mean by perturbation?
9. Minimize $f(X) = x^2 + y^2 + 2$ subject x+y=3 .
10. Write down the Lagrange function and K-T conditions of NLP
    Maximize $f(x) = 8x_1 + 10x_2 - x_1^2 - x_2^2$ subject to $3x_1 + 2x_2 \leq 6; x_1, x_2 \geq 0$.

(8×1=8 weightage)

Part B (Short Essay/Problems)

*Answer any **six** questions.*

*Weight **2** each.*

11. Define canonical form of equations. What is the advantage of putting the equations in a canonical form?

12. Derive the formula $\pi' = -C_0 A_0^{-1}$ where π is the multiplier vector.

13. *Solve graphically:* $Min f(X) = x_1 + x_2$ *subject to* $2x_1 \leq 3, 2x_1 + 2x_2 \geq 5, -2x_1 + 2x_2 \leq 1, x_1, x_2$ *are non-negative.*

14. *Derive Gomory's fractional cut.*

15. Write short note about 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. Define gradient vector and Hessian matrix. Minimize $f(X) = 3x_1^6 + 5x_2^4 + x_2^3$.

(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. *Solve using Branch and Bound method* $Min f(X) = 2x_1 + 3x_2$ *subject to* $2x_1 + 2x_2 \leq 7, 0 \leq x_1 \leq 2, 0 \leq x_2 \leq 2, x_1 \geq 0, x_2 \geq 0$ and x_1, x_2 *are integers.*

21. Find the minimum spanning tree in the following undirected graph.

Arc	(1,2)	(1,3)	(1,4)	(2,3)	(2,8)	(2,10)	)3,4)	(3,8)	(4,5)	(4,6)
Length	7	4	8	3	9	14	4	10	15	12
Arc	(4,8)	(5,6)	(5,7)	(6,7)	(6,8)	(6,9)	(7,9)	(8,9)	(8,10)	(9,10)
Length	10	8	1	2	20	16	18	3	4	6

22. Maximize the function $f(x) = -3x^2 + 21.6x + 1.0$ with a minimum resolution of $\epsilon = 0.5$ over 6 functional evaluations. The optimal value of $f(x)$ is assumed to lie in the range $25 \geq x \geq 0$.

(2×5=10 weightage)