QP CODE: 22000703

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Reg No : ....

Name : ....

M Sc DEGREE (CSS) EXAMINATION, APRIL 2022

Third Semester

Faculty of Science

CORE - ME010305 - OPTIMIZATION TECHNIQUE

M Sc MATHEMATICS,M Sc MATHEMATICS (SF)

2019 ADMISSION ONWARDS

F4FFCFE6

Time: 3 Hours

Weightage: 30

Part A (Short Answer Questions)

*Answer any **eight** questions.*

*Weight **1** each.*

1. Define degenerate basic feasible solution of an LPP.
2. Write the dual of the following LP problem and verify that the dual of the dual is primal.
   Maximize $f(X) = 2x_1 + 3x_2$, Subject to $x_1 - x_2 \leq 2, 3x_1 + 5x_2 \geq 4; x_1, x_2 \geq 0$
3. *If optimal solution of related ILPP exist and $T_F \neq \phi$ prove that optimal solution of associated LPP exist and it is the lower bound for the same.*
4. *Explain Knapsack Problem and its mathematical model.*
5. Define the following with suitable example.
   (i) Directed Graph (ii) Chain (iii) Path
6. Write short note on scheduling sequential activity.
7. State maximum flow minimum cut theorem.
8. Define the terms (i) semi positive definite (ii) semi negative definite
9. What are the two phases used in Hooke and Jeeves algorithm. Explain.
10. Minimize $f(X) = x^2 + y^2 + 2$ subject x+y=3 .

(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. Prove that the optimum value of $f(X)$ of the primal if it exists is equal to the optimum value of $\varphi(Y)$ 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. *Solve the ILPP using cutting plane method*
    Min $z = 9x_1 + 10x_2$ *subject to -*
    $0 \leq x_1 \leq 10, 0 \leq x_2 \leq 8, 3x_1 + 5x_2 \geq 45, x_1 \geq 0, x_2 \geq 0$ *for* x_1*and* x_2 *are integers.*

15. What you mean by 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. Explain how to find the minimum path in a graph with arc lengths are non negative.

17. Define gradient vector and Hessian matrix. Find the point at which $f(X) = x_1 + 2x_3 - x_1^2 - x_2^2 - x_3^2$ is maximum.

18. Write down all Kuhn –Tucker conditions of
    Minimize $z = 100 - 1.2x_1 - 1.5x_2 + 0.3x_1^2 + 0.05x_2^2$ subject to
    $x_1 + x_2 \geq 35, x_1 \leq 11, x_2 \leq 13; x_1, x_2 \geq 0.$

(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 the ILPP using Branch and Bound method Min* $z = 5x_1 + 7x_2$ *subject to* $2x_1 + x_2 \leq 13, 5x_1 + 9x_2 \leq 41, x_1 \geq 0.x_2 \geq 0$ *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 $f(n) = \begin{cases} x/2 & \text{if } n \leq 2 \\ -x+3 & \text{if } n > 2 \end{cases}$ in the interval (0,3) by Fibonacci method using N = 6 and $\epsilon = 0.5$.

(2×5=10 weightage)