21000385

QP CODE: 21000385

Reg No : .....

Name : .....

M Sc DEGREE (CSS) EXAMINATION, MARCH 2021

Third Semester

Faculty of Science

CORE - ME010305 - OPTIMIZATION TECHNIQUE

M Sc MATHEMATICS,M Sc MATHEMATICS (SF)

2019 Admission Onwards

E1B6FB5A

Time: 3 Hours Weightage: 30

Part A (Short Answer Questions)

*Answer any **eight** questions.*

*Weight **1** each.*

1. When will a basic solution become a degenerate basic feasible solution?
2. When we apply Dual Simplex Method?
3. *Solve graphically: Max* $f(X) = 4x_1 + 3x_2$ *subject to* $4x_1 + 5x_2 \leq 20, 5x_1 + 3x_2 \leq 15, x_1 \geq 0, x_2 \geq 0$
4. *Show that if an optimal solution of* $Minf(X)$ *subject to* $X \in S_F$ *is an integer vector,then it also an optimal solution of* $Minf(X)$ *subject to* $X \in T_F$.
5. Define centre of a graph. Give an example for a tree without centre.
6. Describe minimum path problem.
7. Define the terms (1) sink (2) source (3) return arc.
8. What is the working Rule for finding positive and negative definite.
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. Define the following terms:-
    (a) General LP Problem
    (b) Basic solution and basic feasible solution of an LPP.
    (c) Optimal solution of an LPP

12. Write the dual of the following LP problem and verify that the dual of the dual is primal.
    Maximize $f(X) = 4x_1 + 2x_2 + x_3$, subject to
    $x_1 + x_2 \leq 10, 3x_1 + x_2 + x_3 \geq 23, 7x_1 - x_3 \geq 6 \; and \; x_1, x_2, x_3 \geq 0.$

13. *Explain Branch and Bound method.*

14. *Write the mathematical model of Knapsack problem and hence solve the Knapsack problem with Knapsack capacity W= 12*

Object	Weight	Value
1	2	10
2	2	14
3	3	18
4	6	48
5	8	80

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. A project consists of the following activities and the time estimated (in weeks). Find the critical path.

Activity	1-2	1-3	2-6	3-4	3-5	4-6	5-6	5-7	6-7
Duration	4	6	8	7	4	6	5	19	10

17. Define gradient vector and Hessian matrix. Minimize $f(X) = x_1^2 + x_2^2 - 2x_1x_2 + 1.$

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 $f(X) = 3x_1 + 5x_2 + 4x_3$
Subject to $2x_1 + 3x_2 \leq 8, 2x_2 + 5x_3 \leq 10, 3x_1 + 2x_2 + 4x_3 \leq 15; x_1, x_2, x_3 \geq 0$

20. *Solve the ILPP using cutting plane method.*
Max $z = 7x_1 + 10x_2$ *subject to* $-x_1 + 3x_2 \leq 6, 7x_1 + x_2 \leq 35, x_1 \geq 0, x_2 \geq 0$ 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)	(1,5)	(2,3)	(2,5)	(3,4)	(3,5)	(4,5)
Length	6	5	14	18	2	8	8	16	7
Arc	(4,6)	(4,7)	(4,8)	(5,6)	(5,7)	(5,8)	(6,8)	(7,8)	
Length	15	10	9	4	17	12	13	3	

22. Minimize the function $f(x) = 3x^4 + (x-1)^2, 0 \leq x \leq 4$ using Golden Section Search given the resolution parameter $\epsilon = 0.1$.

(2×5=10 weightage)