24P205 (Pages: 2) Name: ….……

Reg. No: ….……..

SECOND SEMESTER M.Sc. DEGREE EXAMINATION, APRIL 2025

(CBCSS - PG)

(Regular/Supplementary/Improvement)

CC19P MTH2 C10 – OPERATIONS RESEARCH

(Mathematics)

(2019 Admission onwards)

Time: Three Hours Maximum:30 Weightage

PART A

Answer ***all*** questions. Each question carries 1 weightage.

1. Define convex function. Give an example for a function which is both convex and concave.
2. Show that the sum of two convex functions is a convex function.
3. Define basic solution and basic feasible solution
4. Define the dual of an LP problem. Illustrate with an example.
5. Prove that the dual of the dual is primal
6. State the complementary slackness conditions
7. What is meant by loop in a transportation array.
8. Solve the game whose payoff matrix is $\begin{bmatrix} 15 & 16 \\ 20 & 5 \end{bmatrix}$

(8 × 1 = 8 Weightage)

PART B

Answer any ***two*** questions from each unit. Each question carries 2 weightage.

UNIT - I

9. Let $f(X)$ be defined in a convex domain $K \subseteq E_n$ and be differentiable. Prove that $f(X)$ is a convex function if and if $f(X_2) - f(X_1) \geq (X_2 - X_1)'\nabla f(X_1)$.
10. Prove that a basic feasible solution of the LP problem is a vertex of the convex set of feasible solutions.
11. Explain degeneracy in linear programming problem

UNIT - II

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. Briefly describe the dual simplex method.
14. Prove that the transportation problem has a triangular basis

UNIT - III

15. Discuss on the introduction of new constraints while determining a new optimal solution from the optimal solution already obtained.
16. Find the minimum path from v_1 to v_8 in the graph with arcs and arc lengths as given below:

Arc	:	(1,2)	(1,3)	(1,4)	(2,3)	(2,6)	(2,5)	(3,5)	(3,4)	(4,7)	(5,6)
Length	:	1	4	11	2	8	7	5	7	3	1

Arc	:	(5,8)	(6,3)	(6,4)	(6,7)	(6,8)	(7,3)	(7,8)
Length	:	12	4	2	6	10	2	2

17. State and prove the fundamental theorem of rectangular games.

(6 × 2 = 12 Weightage)

PART C

Answer any ***two*** questions. Each question carries 5 weightage.

18. Solve graphically:

    Maximize $5x_1 - x_2$

    Subject to $x_1 + x_2 \geq 2,\ \ x_1 + 2x_2 \leq 2,\ \ 2x_1 + x_2 \leq 2,$

    $$x_1 \geq 0, \qquad x_2 \geq 0$$

19. Solve : Minimize $x_1 + 3x_2 + 2x_3$

    Subject to

    $4x_1 - 5x_2 + 7x_3 \leq 8, 2x_1 - 4x_2 + 2x_3 \geq 2, x_1 - 3x_2 + 2x_3 \leq 2; x_1, x_2, x_3 \geq 0$

20. Explain the Branch and Bound method with an example.
21. Solve graphically the matrix game with pay off matrix

$$\begin{bmatrix} 2 & 7 \\ 3 & 5 \\ 11 & 2 \end{bmatrix}$$

(2 × 5 = 10 Weightage)

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