TDC Odd Semester Exam., 2020
held in July, 2021

MATHEMATICS

(Honours)

(5th Semester)

Course No. : MTMH–502

(Linear Programming)

Full Marks : 50
Pass Marks : 17

Time : 2 hours

The figures in the margin indicate full marks for the questions

Answer **five** questions, taking **one** from each Unit

UNIT—I

1. *(a)* Discuss the advantages and disadvantages of a model in OR. 5

(b) Discuss the development of OR in India. 5

2. *(a)* Discuss assumptions of proportionality, aditivity, continuity, certainty and finite choices in the context of linear programming. 5

(b) Find the maximum value of

$Z \quad 2x_1 \quad 3x_2$

subject to

$x_1 \quad x_2 \quad 30$
$x_2 \quad 3, x_2 \quad 12$
$x_1 \quad x_2 \quad 0, 0 \quad x_1 \quad 20$ 5

UNIT—II

3. *(a)* Show that the convex combination of all feasible solutions to an LPP is again a feasible solution to the LPP. 5

(b) Show that the intersection of two convex sets is also a convex set. 3

(c) Show that a hyperplane is a convex set. 2

4. *(a)* Show that the set of all feasible solutions of an LPP is a convex set. 5

(b) Show that a closed convex set which is bounded from below has extreme points on every supporting hyperplane. 5

UNIT—III

5. *(a)* What is the role of surplus variable in simplex method? 2

(b) Write the steps involved in two-phase simplex method. 5

(c) Explain the following with reference to LPP : 3

Entering variable, leaving variable

6. *(a)* Use the Big M-method to

Minimize $Z \quad 60x_1 \quad 80x_2$

$$x_1 \quad 400$$
$$x_2 \quad 200$$
$$x_1 \quad x_2 \quad 500$$
$$x_1, x_2 \quad 0$$

5

(b) Show that the LPP

Maximize $Z \quad 2x_1 \quad 3x_2 \quad 4x_3 \quad x_4$

subject to

$$x_1 \quad 5x_2 \quad 9x_3 \quad 6x_4 \quad 2$$
$$3x_1 \quad x_2 \quad x_3 \quad 3x_4 \quad 10$$
$$2x_1 \quad 3x_2 \quad 7x_3 \quad 8x_4 \quad 0$$
$$x_1, x_2, x_3, x_4 \quad 0$$

has unbounded solution. 5

UNIT—IV

7. *(a)* Obtain the dual problem of the following LPP :

Max $Z \quad 2x_1 \quad 5x_2 \quad 6x_3$

subject to

$$5x_1 \quad 6x_2 \quad x_3 \quad 3$$
$$2x_1 \quad x_2 \quad 4x_3 \quad 4$$
$$x_1 \quad 5x_2 \quad 3x_3 \quad 1$$
$$3x_1 \quad 3x_2 \quad 7x_3 \quad 6$$
$$x_1, x_2, x_3 \quad 0$$

Also verify that the dual of the dual is primal itself. 5

(b) Solve the LPP by duality theory

Max $Z \quad 2x_1 \quad x_2 \quad 3x_3$

subject to

$$x_1 \quad x_2 \quad 2x_3 \quad 5$$
$$2x_1 \quad 3x_2 \quad 4x_3 \quad 12$$
$$x_1, x_2, x_3 \quad 0$$

5

8. *(a)* Find the initial basic feasible solution to the following transportation problem by

(i) minimum cost method

(ii) north-west corner rule

State which of the methods is better.

		To		*Supply*
From	2	7	4	5
	3	3	1	8
	5	4	7	7
	1	6	2	14
Demand	7	9	18	

6

(b) Prove that a necessary and a sufficient condition for the existence of a feasible solution to a transportation problem is that—

total supply = total demand 2+2=4

UNIT—V

9. *(a)* Find the optimal assignment and the optimal cost from the following cost matrix : 7

	M_1	M_2	M_3	M_4
J_1	9	6	6	5
J_2	8	7	5	6
J_3	8	6	5	7
J_4	9	9	8	8

(b) Give a mathematical formulation of the assignment problem. 3

10. *(a)* Explain the difference between a transportation problem and an assignment problem. 4

(b) Discuss the steps of Hungarian method. 6

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