D3AST2403 **(2 Pages)** **Name.....**

Reg. No.....

THIRD SEMESTER M.Sc. DEGREE EXAMINATION, NOVEMBER 2025

(Regular/Improvement/Supplementary)

STATISTICS

FMST3E01 - OPERATIONS RESEARCH

Time: 3 Hours **Maximum Weightage: 30**

Part A: Answer any *four* questions. Each carries *two* weightage.

1. Prove that the set of all feasible solutions of an LPP forms a convex set.
2. State and prove fundamental theorem of duality.
3. Define transportation problem. Explain Vogel's Approximation Method.
4. Define integer programming. Explain Gomory's all integer programming problem method.
5. Write a short note on quadratic programming problem.
6. Explain the costs associated with inventories.
7. Describe a procedure to determine a minimal spanning tree for a given set of nodes and potential links.

(4 × 2 = 8 weightage)

Part B: Answer any *four* questions. Each carries *three* weightage.

8. Use dual simplex method to solve:

Minimize $Z = 3x_1 + x_2$

Subject to $x_1 + x_2 \geq 1$

$2x_1 + 3x_2 \geq 2$

$x_1, x_2 \geq 0$

9. Define sensitivity analysis. Use sensitivity analysis to explain the variation in the cost vector of an LPP.
10. Describe the branch and bound method for the solution of integer programming problem.
11. Solve the following assignment problem.

Machines					
Jobs		A	B	C	D
	J1	5	7	11	6
	J2	8	5	9	6
	J3	4	7	10	7
	J4	10	4	8	3

(P.T.O.)

12. Explain Jacobian method and Lagrangean method for problems with equality constraints.

13. Explain EOQ model with one and two price breaks.

14. Describe the iterative procedure of determining the critical path method.

(4 × 3 = 12 weightage)

Part C: Answer any *two* questions. Each carries *five* weightage.

15. Write down the dual of the following LPP. Solve the dual problem and hence find optimum solution of the primal problem.

$$\begin{aligned} \text{Maximize} \quad & Z = 3x_1 + 5x_2 \\ \text{Subject to} \quad & x_1 \leq 4 \\ & 2x_2 \leq 12 \\ & 3x_1 + 2x_2 \leq 18 \\ & x_1, x_2 \geq 0. \end{aligned}$$

16. Solve the following transportation problem.

	w1	w2	w3	w4	w5	Availability
F1	7	6	4	5	9	40
F2	8	5	6	7	8	30
F3	6	8	9	6	5	20
F4	5	7	7	8	6	10
Requirements	30	30	15	20	5	

17. Explain direct search method and gradient method of nonlinear programming algorithms for the unconstrained problem.

18. The following table shows the jobs of a project with their duration in days. Draw the network and determine the critical path. Also calculate all the floats.

Jobs	Duration	Jobs	Duration
1-2	10	6-7	8
1-3	8	6-9	5
1-4	9	7-10	12
2-5	8	8-10	10
3-7	16	9-10	15
4-6	7	10-11	8
5-7	7	11-12	5
5-8	7		

(2 × 5 = 10 weightage)