BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION SP2024)

CLASS: IMSc. **SEMESTER: IV**
BRANCH: QEDS **SESSION: SP2024**

SUBJECT: ED213 OPTIMIZATION TECHNIQUES

TIME: 02 Hours **FULL MARKS: 25**

INSTRUCTIONS:

1. The question paper contains 5 questions each of 5 marks and total 25 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates**
5. All the notations used in the question paper have usual meanings.

			CO	BL
Q1	A carpenter makes tables and chairs. Each table can be sold for a profit of ₹ 300 and each chair for a profit of ₹ 100. The carpenter can afford to spend up to 40 hours per week working and takes 6 hours to make a table and 3 hours to make a chair. Customer demand requires that he makes at least three times as many chairs as tables. Tables take up four times as much storage space as chairs and there is room for at most four tables each week. Formulate this problem as a linear programming problem (LPP) to maximize the total profit and solve it graphically.	[3+2]	CO1	1,2
Q2	Using appropriate slack/surplus/artificial variables set up an initial simplex table to solve the following problem using Big-M method (penalty method) and identify the pivot element for the first iteration. $\mathbf{max}\ x_1 + 2x_2 + 3x_3 - x_4;\ \mathbf{sub\ to}\ x_1 + 2x_2 + 3x_3 = 15, 2x_1 + x_2 + 5x_3 = 20,$ $x_1 + 2x_2 + 3x_3 + x_4 = 10; x_j \geq 0\ \forall j = 1, 2, 3, 4.$	[3+2]	CO1	2
Q3	By solving dual of the following problem find the optimal solution of both the primal and dual problems; and verify the complementary slackness principle related to optimal solution of linear primal and its dual optimization problems. $\mathbf{max}\, z = 2x_1 + 3x_2; \mathbf{sub\ to}\ -x_1 + 2x_2 \leq 4, x_1 + x_2 \leq 6, x_1 + 3x_2 \leq 9; x_1, x_2 \geq 0$	[3+2]	CO2	2
Q4	A steel company has three open hearth furnaces and five rolling mills. Transportation costs (rupees per quintal) for transporting steel from furnaces to rolling mills are shown in the following table. Obtain the initial basic feasible solution for the transportation schedule by Vogel's approximation method and check the degeneracy of the initial basic feasible solution.	[4+1]	CO2	3

	M_1	M_2	M_3	M_4	M_5	a_i
F_1	4	2	3	2	6	8
F_2	5	4	5	2	1	12
F_3	6	5	4	7	7	14
b_j	4	4	6	8	8	

Q5	The initial transportation schedule for a transportation problem is given as: $x_{12} = 10, x_{13} = 4, x_{21} = 1, x_{23} = 11, x_{31} = 5$. Find the optimal shipping schedule between the suppliers and consumers, and minimum transportation cost by modified distribution (MODI) method.	[5]	CO2	3

Consumer→ / Supplier↓	A	B	C	Availability
I	6	8	4	14
II	4	9	3	12
III	1	2	6	5
Requirements	6	10	15	31

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