BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION SP2023)

CLASS: IMSc. **SEMESTER : IV**
BRANCH: QEDS **SESSION : SP2023**

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**

			CO	BL
Q.1(a)	A factory is engaged in manufacturing two products A and B which involve lathe work, grinding and assembling. The cutting, grinding, and assembling times required for one unit of A are 2, 1 and 1 hours respectively, and for one unit of B are 3, 1 and 3 hours respectively. The profits on each unit of A and B are ₹ 2.00 and ₹ 3.00 respectively. If 300 hours of lathe time, 300 hours of grinding time and 240 hours of assembling time are available, construct a linear programming model in terms of maximizing the profit on the items to be manufactured.	[3]	CO1	
Q.1(b)	Solve the Linear programming problem, constructed in Q1(a) using graphical method	[2]		
Q.2(a)	Using appropriate slack/surplus/artificial variables reduce the following problem in its standard form with non-negative variables. $\max\ 3x_1 + 2x_2 + 5x_3;\ \text{sub to}\ 2x_1 - 3x_2 \leq 3, 4x_1 + 2x_2 - 4x_3 \geq 5,$ $2x_1 + 3x_3 \leq 2; x_1, x_2 \geq 0$ and x_3 is unrestricted in sign.	[3]	CO1	
Q.2(b)	Set up the initial simplex table to solve the problem in Q2(a) using Big-M method.	[2]		
Q.3(a)	State complementary slackness principle related to optimal solution of linear primal and its dual optimization problems.	[2]	CO2	
Q.3(b)	By solving dual of the following problem find the optimal solution of both the primal and dual problems. $\max z = 2x_1 + 3x_2; \text{sub to}\ -x_1 + 2x_2 \leq 4, x_1 + x_2 \leq 6, x_1 + 3x_2 \leq 9; x_1, x_2 \geq 0$	[3]		
Q.4	For the following minimization type unbalanced transportation problem, obtain the initial basic feasible solution by Vogel's approximation method.	[5]	CO2	

	W_1	W_2	W_3	W_4	a_i
P_1	3	8	7	4	30
P_2	5	2	9	5	50
P_3	4	3	6	2	80
b_j	20	60	55	40	

Q.5	A transportation company has the following problem. The supply (in truckloads), the demand (also in truckloads) and the unit transportation cost (in hundreds of rupees) per truckload on the different routes are summarized below. The company has an initial shipping schedule: $x_{11} = 5, x_{14} = 2, x_{23} = 7, x_{24} = 2, x_{32} = 8$ and $x_{34} = 10$. Find the optimal shipping schedule between the silos and mills, and minimum transportation cost by Steppingstone algorithm.	[5]	CO2	

	Mills					
		I	II	III	IV	Supply
Silos	A	19	30	50	10	7
	B	70	30	40	60	9
	C	40	8	70	20	18
	Demands	5	8	7	14	

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