BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: MTECH **SEMESTER : II**
BRANCH: CS **SESSION : SP/2025**

SUBJECT: CS630 MODERN OPTIMIZATION TECHNIQUES

TIME: 3 Hours **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

			CO	BL
Q.1(a)	Explain with suitable examples the terms Slack variable, Surplus variable, Penalty cost and artificial variable? Also explain the reason why they are introduced into a problem.	[5]	1	1,2
Q.1(b)	A farmer has 9 acres of land. He is planning compulsorily for the production (in tons) of both Horticulture(x_1) and high class Peddy crop(x_2) simultaneously so that in unsupportive weather conditions, profit could be optimized. It is assumed that production will be in tons. Horticulture crops take 2 half year time while Peddy crops take only 1 half year time to get ready. Total Land use for Horticulture is always a multiple of 2 (i.e. 2 acres, 4 acres, …) while that is for Peddy crop is always a multiple of 3 (i.e. 3 acres, 6 acres, …). The selling price of Horticulture crops and Peddy crops is 3 and 4 lakhs per ton respectively. Plan the effective use of land for both crops so that in time period of 3 years(6 half years) the profit could be maximized.	[5]	1,2	4,5,6
Q.2(a)	What is first approximation in Integer programming? How is Branching done in solving a problem in Integer programming? What is the meaning of Bounding in Integer programming? Explain each in detail.	[5]	1,2	1,2
Q.2(b)	Using Branch and Bound algorithm, maximize $z = x_1 + 2x_2 + x_3$ subject to $2x_1 + 3x_2 + 3x_3 <= 11$ with all variables are nonnegative and integers	[5]	1,2	4,5
Q.3(a)	Explain the terms Local and Global optima with proper example. What do you mean by Convex function? Demonstrate with example.	[5]	1,3	1,2
Q.3(b)	Using Fibonacci search technique, approximate the location of maximum of f(x) = x(7-x) on [0, 30] with ebsilon = 1	[5]	1,3	1,2,3
Q.4(a)	Write short notes (with their application) on Simulated Annealing and Tabu search	[5]	1,4	1,2
Q.4(b)	Write short notes on Variable Neighborhood Search Technique and Swarm Intelligence	[5]	1,4	1,2
Q.5(a)	The given data represents the steel industry production (x) and Tala steel production (y) in tons	[5]	1,2,5	3,4,5

Years

Years	1	2	3	4	5	6	7	8
x	1103	1250	1097	955	945	903	1025	1170
y	105	117	110	101	97	92	104	116

(i) If the industry estimates next year's production 1300 tons, forecast production of Tala steel for next year.
(ii) Compute the correlation coefficient and interpret it.
(iii) How much of the variation in Tala steel production is explained by industry production?

Q.5(b)	Find next year's forecast using time linear regression for the following data on yearly arrival of foreign tourist (in millions) to Jambo state.									[5]	1,2,5	3,4,5

Year	1	2	3	4	5	6	7	8	9	10	11
Tourist in million	9.94	11.25	11.98	10.91	8.83	10.40	8.90	10.26	11.64	13.80	15.10

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