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

CLASS: MTECH/PRE-PHD **SEMESTER: FIRST**
BRANCH: CIVIL & ENV. ENGG. **SESSION: MO/2025**

SUBJECT: CE582 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 handbook/Graph paper etc. to be supplied to the candidates in the examination hall.

			CO	BL
Q.1(a)	What is optimization? Why do we need optimization? Explain with mathematical form.	[3]	1	I
Q.1(b)	Plot any function, say, x vs $f(x)$ to define the concepts of local and global optima.	[3]	1	II
Q.1(c)	Two plants in a Company, produce and supply products A and B. Each plant can operate up to 10 hours a day. In plant 1, it takes 3 hours to prepare and pack 600 gallons of A and 1 hour to prepare and pack 300 gallons of B. In plant 2, it takes 2 hours to prepare and pack 1,000 gallons of A and 1.5 hours to prepare and pack 700 gallons of B. In plant 1, it costs Rs 15,000 to prepare and pack 1,000 gallons of A and Rs 18,000 to prepare and pack 1,000 gallons of B, whereas in plant 2 these costs are Rs 18,000 and Rs 16,000, respectively. The company tries to produce daily at least 10000 gallons of A and 5000 gallons of B. Construct the linear programming problem. Constraints should be on preparation time and minimum daily production requirement.	[4]		III
Q.2(a)	What are the two methods of removing artificial variables? Explain.	[3]	1	II
Q.2(b)	Find a solution to this problem using Big-M Simplex Method. $$Minimize: Z = 3x_1 - x_2$$ $$Sub.\ to \rightarrow 2x_1 + x_2 \geq 2,\quad x_1 + 3x_2 \leq 2,\quad x_2 \leq 4,\ x_1, x_2 \geq 0$$	[7]	2	III
Q.3	Solve the following integer programming problem using the Branch and Bound method. $$Maximize: Z = 2x_1 + 3x_2$$ $$Sub.\ to \rightarrow 6x_1 + 5x_2 \leq 25,\quad x_1 + 3x_2 \leq 10,\quad x_1, x_2 \geq 0 \text{ and integers}$$	[10]	2	III
Q.4(a)	Explain one-variable, multi-variable constrained and unconstrained optimization with example.	[2]	1	II
Q.4(b)	Define convex and concave function with graphical illustration.	[3]	1	II
Q.4(c)	Solve the following nonlinear optimization problem. $$Minimize: Z = x_1^2 + (x_2 + 1)^2 + (x_3 - 1)^2$$ $$Sub.\ to \rightarrow x_1 + 5x_2 - 3x_3 = 6,\quad x_1, x_2, x_3 \geq 0$$	[5]	2	III
Q.5(a)	Define Genetic Algorithm (GA). Discuss GA based optimization and its components.	[5]	3	I
Q.5(b)	Discuss neural network-based optimization.	[5]	3	I

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