2123
M.E. (Mechanical Engineering)
Third Semester
MME-302(e): Optimization Techniques

Time allowed: 3 Hours

Max. Marks: 50

NOTE: *Attempt* <u>*five*</u> *questions in all, selecting atleast two questions from each Part. Use of graph paper is allowed*

x-x-x

PART A

1. Use Big-M method to solve the following LP problem: 10

$$\text{Minimize} \quad Z = 5x_1 + 4x_2$$
$$\text{subject to} \quad 10x_1 + 4x_2 \geq 15,$$
$$5x_1 + 8x_2 \geq 10,$$
$$\text{and } x_1, x_2 \geq 0$$

2. $\text{Maximize} \quad Z = 3x_1 + 5x_2$ 10
$$\text{subject to} \quad x_1 + 2x_2 \leq 2000,$$
$$x_1 + x_2 \leq 1500,$$
$$x_2 \leq 600,$$
$$\text{and } x_1, x_2 \geq 0$$

Determine the optimal solution graphically and henceforth find the range of coefficient C_1 of variable x_1 in the objective function such that the current optimal solution remains unchanged.

3. Solve the following NLPP: 10

$$\text{Maximize} \quad Z = 10x_1 - x_1^2 + 10x_2 + x_2^2$$
$$\text{subject to} \quad x_1 + x_2 \leq 9,$$
$$x_1 - x_2 \geq 6,$$
$$\text{and } x_1, x_2 \geq 0$$

4. Discuss the problem solving approach of following methods by taking a suitable example: 5,5

   (i) Penalty function approach   (ii) Random search method

PART B

5. Solve the following integer programming problem using branch and bound method: 10
$$\text{Maximize} \quad Z = 2x_1 + 3x_2$$
$$\text{subject to} \quad 6x_1 + 5x_2 \leq 25,$$
$$x_1 + 3x_2 \leq 10,$$
$$\text{and } x_1, x_2 \geq 0 \text{ and are integers.}$$

6. A travelling salesman has to visit 4 cities. He does not want to visit any city twice before completing the tour of all the cities and wishes to return to his home city, the starting station. The travelling cost (in thousands of Rupees) of each city from a particular city is given below. Find the least cost route. 10

		To city			
		1	**2**	**3**	**4**
	1	---	2	5	7
From city	*2*	2	---	7	8
	3	5	7	---	6
	4	7	8	6	---

P.T.O.

7 (a) Discuss the advantages and limitations of population based optimization techniques over point-to-point based methods.   5

(b) Discuss the role of following genetic operators: Reproduction and Crossover.   5

8 (a) Explain the working of Genetic algorithm technique to solve an optimization problem by considering a simple example.   5

(b) Enlist the differences between GAs and traditional methods.   5

x-x-x