

Name:.....

Roll No.:.....

NATIONAL INSTITUTE OF TECHNOLOGY CALICUT

Department of Mechanical Engineering

Final Year B.Tech. Test II, Winter Semester 2021**ME 4126D OPTIMIZATION METHODS IN ENGINEERING**

Time: 100 minutes

Maximum Marks: 20

*Answer **ALL** questions**Assume any missing data, clearly stating the assumption*

Q.No

Questions

Marks

1. Solve the following quadratic programming problem (4)
- Minimize: $f(x_1, x_2) = x_1^2 - x_1x_2 + 3x_2^2 - 4x_2 + 4$
- Subject to: $x_1 + x_2 \leq 1$
 $x_1, x_2 \geq 0$
2. The H-D company wishes to schedule the production of a kitchen appliance that requires two resources- labor and material. The company is considering two models and its production engineering department has furnished the following data: (4)

Models		
	A	B
Labor (hours per unit)	9	7
Material (Kgs per unit)	7	20
Profit (Rupees Per unit)	40	90

The supply of raw materials is restricted to 70 kgs per day. The daily availability of labor is 56 hours. Formulate and solve an Integer linear programming model to determine the daily production rate of the various models in order to maximize the total profit using Branch and Bound Method

3. Minimize the following objective function using golden section search and use the resolution $\epsilon = 0.10$, $f(x) = 3x^4 + (x-1)^2$, $4 \geq x \geq 0$ (4)
4. Sharon Inc. has two grades of quality inspectors, 1 and 2, who are to be assigned for a quality control inspection. It is required that at least 3600 pieces be inspected per 8-hour day. Grade 1 inspectors can check pieces at a rate of 50 pcs. /hr., with an accuracy of 98%. Grade 2 inspectors can check pieces at a rate of 30 pcs. /hr., with an accuracy of 95%. The wage rate of a Grade 1 inspector is \$5.00/hr., while that of Grade 2 inspector is \$3.00/hr. Each time an error is made by an inspector, the cost to company is \$2.00. The company has available for the inspection job eight Grade 1 inspectors, and ten Grade 2 inspectors. The company wants to determine the optimal assignment of inspectors, which will minimize the total cost of the inspection. Formulate the LP problem and solve using graphical method. (3)
5. a. Differentiate between set covering and set partitioning models. Give two examples. (2+3)

b. A firm has four possible sites for locating its warehouses. The cost of locating a warehouse at site i is $\$K_i$. There are nine retail outlets, each of which must be supplied by at least one warehouse. It is not possible for any one site to supply all the retail outlets as shown in Figure below. The problem is to determine the location of the warehouse such that the total cost is minimized. Formulate the problem as Integer programming model.

