Exam.Code:1016
Sub. Code: 7460

2122
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.*

x-x-x

PART-A

1. a) Why do some problems have multiple optimal feasible solutions? How such information is useful for decision making ? Explain. **5**

   b) Explain the following concept in the context of liners programming: **5**
   i) Convex polygon . ii) Redundant constraints .

2. a) Define the gradient of the function. Explain its importance in the multi variable optimization. **10**
   b) Using the variable metric method, find the minimum of the function
   Min $f(X) = x1^2 - x_1x_2+3x_2^2$.
   Take initial point as [1,2].

3. Solve the following program by use of the Kuhn-Tucker conditions: **10**
   minimize: $Z=x_1^2 +5x^2_1 + 10x^2_3 - 4x_1x_2 + 6x_1x_3 - 12x_2x_3 - 2x_1 + 10x_2 + 5x_3$
   subject to: $x_1 + 2x_2 + x_3 \geq 4$ with: all variables non negative.

4. Find the optimal cost of the following transportation model: **10**

	D1	D2	D3	D4	Supply
O1	12	18	13	20	50
O2	17	11	16	15	60
O3	11	10	14	13	40
Demand	20	25	10	35	

PART-B

5. Employing graphical method, minimize the distance of the origin from the concave region bounded by the constraint : **10**

   $x_1+x_2 \geq 4$

   $2x_1+x_2 \geq 5$

   $x_1, x_2 \geq 0$

   Verify that the Kuhm-Tucker necessary conditions hold at the point of minimum distance.

P.T.O.

6.	Find the optimum solution of the following constrained multivariable problem: Minimize $Z = x_1^2 + (x_2 + 1)^2 + (x_3 - 1)^2$ Subject to $x_1 + 5x_2 - 3x_3 = 6$.	10
7.	Explain application of optimization in design and analysis of springs and gears.	10
8.	a) Compute the mutation and crossover in a genetic algorithm with real numbers. Explain in detail.	3
	b) One of management's goals in a goal programming problem is expressed algebraically as, $3x1 + 4x2 + 2x3 = 60$, where 60 is the specific numeric goal and the left-hand side gives the level achieved toward meeting this goal. (i) Letting y+ be the amount by which the level achieved exceeds this goal (if any) and y- the amount under the goal (if any), show how this goal would be expressed as an equality constraint when reformulating the problem as a linear programming model. (ii) If each unit over the goal is considered twice as serious as each unit under the goal, what is the relationship between the coefficients of y+ and y- in the objective function being minimized in this linear programming model?	7

x-x-x