DEPARTMENT OF ELECTRONICS & COMMUNICATION
Research Methodologies and Techniques (Code: ECEM-212)

Date: 05/11/2017 Deadline: Wednesday (09/11/2017) Morning *Homework 2 for PhD Scholars, 1st semester.*

1. Solve the following simple optimization problem, for

$$f(x_1, x_2) = x_1 + x_2$$

$$\min_x f(x_1, x_2)$$
$$\text{subject to } x_1^2 - x_2 = 0$$

2. Solve the following optimization problem,

$$\min_{x,y} f(x, y) = x^2 + y^2 + 3xy + 6x + 19y$$
$$\text{subject to } 3y + x = 5$$

3. Recall the definition of convex function and show that the following function is convex

$$f(x_1, x_2, x_3) = x_1^2 + x_2^2 + x_3^2 - x_1 - x_2 - x_3 \quad (1)$$

Hence solve the following optimization problem (here $x \in \mathrm{R}, y \in \mathrm{R}$)

$$\min_x f(x_1, x_2, x_3) \quad (2)$$
$$\text{subject to } x_1^2 + x_2^2 = 4 \quad (3)$$

4. If objective function is defined as

$$f(x_1, x_2) = -x_1 - x_2$$

Solve the following optimization problem

$$\min_x f(x_1, x_2)$$
$$\text{subject to } x_2 - x_1^2 \geq 0$$
$$1 - x_1^2 - x_2^2 \geq 0$$

(Hint: Use KKT optimality conditions with two lagrange multipliers)

Student's name:

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5. Use KKT optimality conditions for solving the following optimization problem

$$\begin{aligned} &\max (x+1)^2 + (y+1)^2 \\ &\text{subject to } x^2 + y^2 \leq 2 \\ &y \leq 1 \end{aligned}$$

Is the solution optimal (i.e. Global mininum, if yes why if not why not).