Roll No……. Code: TCD 2003

Name…….

Second Semester M.Tech AEI
Model Question, November 2014
OPTIMIZATION TECHNIQUES

Time: 3 Hours Max. Marks: 60

Answer any two questions from each module. Each question carries 10 marks.

Module I

I.

a. Consider the function $f(x)=2x_1^2+4x_1x_2^3-10x_1x_2+x_2^2$. Prove that the point $x^*=(0,0)^T$ is a saddle point.

b. Let $f(x_1,x_2) = (x_1^2 + x_2-11)^2 + (x_1+x_2^2-7)^2$ and consider the point $x^{(t)}=(1,1)^T$ Check whether the direction $d^{(t)}=(1,0)^T$ at the point $x^{(t)}$ is a descent direction or not and also find the steepest direction at the point.

II.

a. Minimize the function $f(x) =x^2 + 54/x$ in the interval (0, 5) using Fibonacci search method. Let initial interval L=5 and desired number of function evaluations 'n' to be 3. Also find the number of function evaluations required to obtain an accuracy of 0.001.

b. Explain Golden Section Search Algorithm.

III. Explain Gradient based Methods and briefly explain any one gradient based method with algorithm.

Module II

IV.

Consider the minimization problem given by

Minimize $f(x)= x_1^2-x_2$

Subject to $g_1(x) =x_1-1\geq 0$

$g_2(x) = 26-x_1^2-x_2^2\geq 0$

$h_1(x) =x_1+x_2-6=0$

Prove that $x^* = (1, 5)$ is an optimal solution by using Kuhn Tucker theorem?

V.

a. A manufacturing firm produces two machine parts using lathes, milling machines and grinding machines. The different machining times required for each part, the machining times available on different machines and the profit on each machine part are given in the following table

Type of machines	Machining Time required (in minutes)		Maximum time available per week(in minutes)
	Machine Part 1	Machine Part II	
Lathes	10	5	2500
Milling Machines	4	10	2000
Grinding machines	1	1.5	450
	Profit per machine part 1 = $50	Profit per machine part II = $100	

Formulate an LP model to determine the number of machine parts I and II to be manufactured per week to maximize the profit.

b. Maximize $Z = 3x_1 + 2x_2$

Subject to $-x_1 + 2x_2 \leq 4$

$3x_1 + 2x_2 \leq 14$

$x_1 - x_2 \leq 3$

$x_1, x_2 \geq 0$

using Simplex Method.

VI.

a. Explain penalty function search method and the various penalty functions used.

b. Minimize $f(x) = (x_1-4)^2 + (x_2-4)^2$ subject to $h(x) = x_1 + x_2 - 5 = 0$ using parabolic penalty function.

Module III

VII. Explain Artificial Bee Colony Optimization (ABC) Algorithm.

VIII. Explain meta heuristic optimization techniques with any one example showing its significance in the field control systems.

IX. Explain Harmony Search Algorithm.