Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

ME Semester –I Examination Feb. - 2012

Subject code: 710903N **Date: 17/02/2012**
Subject Name: Engineering Optimization
Time: 10.30 am – 01.00 pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** A log of length l is in the form of a frustum of a cone whose ends have radii a and b ($a>b$) .It is required to cut from it a beam of uniform square section. Prove that the beam of greatest volume that can be cut has a length of $al/[3(a-b)]$. **05**

(b) Determine whether the function is concave or convex. $f(x,y,z)=4x^2+2y^2+z^2+10x+14y+6z-10$. **05**

(c) State the necessary and sufficient condition for the maximum of a multivariate function f(X). **04**

Q.2 **(a)** Minimize $f(X)=x_1^2+x_2^2+60x_1$ subject to the constraints $g_1=x_1-80\geq 0$, $g_2=x_1+x_2-120\geq 0$.Using Kuhn Tucker conditions. **07**

(b) Consider $f(X)=(x_1-3)^2+(x_2-3)^2$ for $X^{(0)}=[1,1]^T$, **07**

(i) Find the steepest descent direction at $X^{(0)}$

(ii) Can $d^*=[-1,-2]^T$ be a descent direction?

(iii) Can $d^{**}=[1,1]^T$ be a feasible direction?

OR

(b) An electric light is placed directly over the center of a circular plot of lawn 100m in diameter. Assuming that the intensity if light varies directly as the sin of the angle at which it strikes an illuminated surface, and inversely as the square of its distance from the surface, how high should the light be hung in order that the intensity may be as greater as possible at the circumference of the plot? **07**

Q.3 **(a)** Find the dimensions of a cylindrical tin (with top and bottom) made up of sheet metal to maximize its volume such that the total surface is equal to $A_0=24\pi$. **07**

(b) What is the Hessian matrix for $f(X)=x_1^2+(x_1+x_2)^2+(x_1+x_3)^2$.Also determine local extrema. **07**

OR

Q.3 **(a)** Minimize $f(X)=\frac{1}{3}(x_1+1)^3+x_2$ subject to **07**

$g_1=-x_1+1\le 0$
$g_2=-x_2\le 0$ Using the interior penalty method.

(b) Minimize $f(X)=2x_1^{-1}x_2^{-1}+\frac{3}{2}x_2^{-2}+2x_1x_2^2$ by geometric programming technique. **07**

Q.4 **(a)** Minimize $f(x)=(100-x)^2$ over $60\le x\le 150$ using Fibonacci method for *n*=5. **07**

(b) Find the minimum of the function $f(x)=x^3-3x-5=0$ by the Newton's method with the starting value of x_0 =2.Carry out five iterations. **07**

OR

Q.4 **(a)** Differentiate between: **07**
(i)Posynomial and Polynomial
(ii)Linear programming problem and Non linear programming problem.
(ii)Single objective and multi objective programming problem.

(b) Minimize $f(X)=2x_1^2+12x_1x_2-7x_2^2$ subject to , **07**

$2x_1+5x_2-98\le 0$
$x_1,x_2\ge 0$ Using exterior penalty function method.

Q.5 **(a)** Minimize $f(X)=x^2-\sin x,[0,1]$ correct to an interval accuracy of 0.1uing Golden Section Method. **07**

(b) Find the minima of function $f(X)=x_1^2-3x_1x_2+4x_2^2+x_1-x_2$ with starting point $(1,1)^T$ using conjugate gradient method. **07**

OR

Q.5 **(a)** Consider the minimization of the objective function $f=x^5-5x^3-20x+5$. Carry out two iterations, using quadratic interpolation method with initial interval of uncertainty [0,5]. Use polynomial $f(x)=a_0+a_1x+a_2x^2$. **07**

(b) Write short note on Simulated annealing and geometric algorithm. **07**

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