Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – III • EXAMINATION – SUMMER • 2013

Subject code: 730801 **Date: 13-05-2013**

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)** Explain constrain surface in a hypothetical 2d design space with appropriate figure. **07**

(b) A wooden log in the form of a frustum of a cone 30m long the radii of its ends being 2m and 1m. A beam of circular cross-section is to cut from this log. Find the length of the beam of the maximum volume. **07**

Q.2 **(a)** A tent on a square base of side 2a consists of four vertical sides of height b surmounted by a regular pyramid of height h, if the volume enclosed by the tent is V, show that the area of the canvas in the tent can be expressed as : **07**

$$\frac{2v}{a} - \frac{8ah}{3} + 4av(a^2 + h^2)$$

(b) Minimize: $f(x) = 2x^4 - x^3 + 5x^2 - 12x + 1$ using Quadratic interpolation. Carry out at least 2 intervals, the optimum solution lies between the range (0, 1). **07**

OR

(b) Minimize: $f(x) = 2x^4 - x^3 + 5x^2 - 12x + 1$ using Newton Raphson method with starting point $x_0 = 0$. **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 total surface area $A_0 = 24p$. **07**

(b) Explain Fibonacci method with suitable example. **07**

OR

Q.3 **(a)** Explain Interval Halving method. **07**

(b) Define saddle point with its characteristics. Find the extreme points of the function $f(x_1,x_2) = x_1^3 + x_2^3 + 2x_1^2 + 4x_2^2 + 6$ **07**

Q.4 **(a)** An electric light is placed directly over a center of a circular plot of lawn 100m in diameter. Assuming that intensity of light varies directly as the sine of the angle at which it strikes on the illuminated surface and inversely as square of its distance from the surface. How far the light should be hung in order that the intensity may be as great as possible at the periphery of the plot. **07**

(b) Maximize using Kuhn-Tucker condition **07**

$f(x) = 6x_1 + 3x_2 - x_1^2 + 4x_1x_2 - 4x_2^2$;

subjected to: $x_1 + x_2 = 3$

$4x_1 + x_2 = 9$

OR

Q.4 **(a)** Perform 3 iterations of the steepest decent method on **07**

$f(x_1,x_2) = x_1^2 + 2x_2^2 - 4x_1^2 - 2x_1x_2$; with starting point $x_0 = (0,0)^T$

Q.4	**(b)**	How does geometric programming differs from other optimization techniques? What is meant by degree of difficulty in geometric programming?	**07**
Q.5	**(a)**	Describe a simple genetic algorithm for optimum design? How does it differ from traditional methods?	**07**
	(b)	An open cylinder vessel is to be constructed to transport $1000m^3$ of a chemical from a store to a factory. The sheet metal used for the bottom cost Rs 1000/- and that used for cylindrical wall cost Rs 500/- per square meter. If it costs Rs 100/- for each round trip of the vessel, find the dimensions of the vessel for minimizing the transportation cost. Assume that the vessel has no salvage upon completion of operation.	**07**

OR

Q.5	**(a)**	Show that volume of longest right circular cylinder that can be inscribed in a right circular cone is $4/9^{th}$ of the volume of cone.	**07**
	(b)	Explain Lagrange multiplier method. What is the significance of Lagrange multiplier?	**07**

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