Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Sem-I Regular Examination January / February 2011

Subject code: 710903N **Subject Name: Engineering Optimization**

Date: 02 / 02 /2011 **Time: 02.30 pm – 05.00 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 wooden log in the form of a frustum of a cone 30m long the diameters 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**

(b) (i) State the necessary and sufficient conditions for minimum of convex programming problem with inequality constraints. **03**

(ii) Define saddle point. Find the condition that the quadratic $ax^2 + 2hxy + by^2 + 2fx + 2gy + c$ may be concave or convex. **04**

Q.2 **(a)** Minimize $f(x_1, x_2) = x_1^2 + x_2^2 + 60x_1$ subject to the constraints, **07**

$g_1 = x_1 - 80 \geq 0$

$g_2 = x_1 + x_2 - 120 \geq 0$

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

OR

(b) Solve for the value of x that maximizes $f(x) = -1.5x^6 - 2x^4 + 12x$ using Newton's method with starting value of $x_0 = 2$. **07**

Q.3 **(a)** Use the method of Lagrange's multipliers and check that satisfy the necessary and sufficient conditions for the problem: **07**

$f(X) = 2x_1^2 - 24x_1 + 2x_2^2 - 8x_2 + 2x_3^2 - 12x_3 + 200$,Subject to constraint : $g_1 = x_1 + x_2 + x_3 = 11, (x_1, x_2, x_3 > 0)$

(b) Define the following types of problems: **07**

(a) Quadratic programming problem

(b) Linear programming problem

(c) Stochastic programming problem

OR

Q.3 **(a)** Using Exhaustive search method find minimum of $f(x) = x(x-1.5)$ in the interval (0.0, 1.0) to within 10% of he exact value. **07**

(b) Discuss the method of bracketing the minimum of a unimodal function in an interval. **07**

Q.4 **(a)** Using golden section search stopping after four iteration maximize $f(x) = 3 + 6x - 4x^2$ on the interval[1,2] **07**

(b) Using Fibonacci method find an approximate value of the function: $f(x) = x^2 - 2.6x + 2, -2 \le x \le 3$ .Chose $\delta = 0.01, l = 0.2$ **07**

OR

Q.4 **(a)** Solve using the cutting plane method the integer linear programming problem **07**

Maximize: $Z = x_1 + 2x_2$ subject to,

$$-\frac{1}{3}x_1 + \frac{1}{5}x_2 \le \frac{1}{5}$$

$$-\frac{1}{5}x_1 + \frac{1}{3}x_2 \ge -\frac{1}{5}$$

$$x_1 + x_2 \le 5$$

$$x_{1,}x_2 \ge 0$$

And integer valued.

(b) Minimize: $f = 5x_1x_2^{-1}x_3^{2} + x_1^{-2}x_2^{-1} + 10x_2^{3} + 2x_1^{-1}x_2x_3^{-2}$, **07**

Using geometric programming method.

Q.5 **(a)** (i) What is the Hessian matrix of, **04**

$f(x_1, x_2) = 2x_1^2 - 7x_1x_2 - 5x_2^2 + 4x_1 - 11x_2 + 4$?

(ii)What is gradient vector State the properties of gradient vector. **03**

(b) Minimize: $f(x_1, x_2) = x_1 - x_2 + 2x_1^2 + 2x_1x_2 + x_2^2$ starting with $(0,0)^T$,using conjugate gradient method. **07**

OR

Q.5 **(a)** Perform 3 iteration of the Steepest decent method on, $f(x_1, x_2) = 0.2x_1^2 + x_2^2$ starting at point $(4,4)^T$. **07**

(b) Find the minimizer of the following quadratic function, **07**

$$f(x) = (1/2)(x_1, x_2)\begin{bmatrix} 4 & -2 \\ -2 & 16 \end{bmatrix}(x_1, x_2)^T + (2,-5)(x_1, x_2)^T$$

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