Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – III • EXAMINATION – WINTER 2012

Subject code: 730801 **Date: 30-12-2013**

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 Classifications of Optimization Methods. **07**

(b) Formulate the problem of minimum weight design of a helical spring under axial load as a geometric programming problem. Consider constraints on the shear stress, natural frequency, and buckling of the spring. **07**

Q.2 **(a)** Explain the difference between Elimination and Interpolation methods of Optimization. **07**

(b) Define the terms Design variables and Pre-assigned parameters and differentiate them. **07**

OR

(b) State the necessary and sufficient conditions for the maximum of a Multivariable and Multi objective function with illustrative example. **07**

Q.3 **(a)** Maximize $f(x) = x_1 + x_2$ Subject to $x_1^2 + x_2^2 = 1$ using Lagrange multiplier method **07**

(b) Differentiate Fibonacci and golden section methods of optimization? **07**

OR

Q.3 **(a)** What is Genetic Algorithm? What are the basic operations used in GAs. **07**

(b) Why Stochastic programming is needed in Engineering Optimization? Explain stochastic linear programming method in detail. **07**

Q.4 **(a)** Explain Generalized Reduced Gradient Method of optimization with its significance. **07**

(b) Minimize $f(x_1, x_2) = x_1 - x_2 + 2x_1^2 + 2x_1x_2 + x_2^2$ starting from the point $\mathbf{X}_1 = \{0\ 0\}^T$ up to three iterations using method of steepest descent. **07**

OR

Q.4 **(a)** Explain Cubic Interpolation Method of optimization with the help of flowchart. **07**

(b) Minimize the function f using Geometric Programming method. **07**

$$f = x_1x_2^2x_3^{-1} + 2x_1^{-1}x_2^{-3}x_4 + 10x_1x_3$$

subject to

$$3x_1^{-1}x_3x_4^{-2} + 4x_3x_4 \le 1$$

$$5x_1x_2 \le 1$$

Q.5 **(a)** What is Convergence? Differentiate between linear and super-linear convergence. **07**

(b) Minimize $f(x) = x_1^2 - x_2$ **07**

Subject to $x_1 + x_2 = 6$

$x_1 - 1 \ge 0$

$x_1^2 + x_2^2 \le 26$

OR

Q.5 **(a)** Enlist MATLAB Functions and explain any TWO for Solving Optimization Problems in MATLAB Optimization Toolbox. **07**

(b) Write a MATLAB program to **07**

Minimize $f(X) = x_1^3 - 6x_1^2 + 11x_1 + x_3$

subject to $x_1^2 + x_2^2 - x_3^2 \leq 0$

$4 - x_1^2 - x_2^2 - x_3^2 \leq 0$

$x_3 - 5 \leq 0$

$-x_i \leq 0$, $i = 1, 2, 3$ initial point is $X_1 = \{0.1\ 0.1\ 3.0\}^T$

****