Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E. SEMESTER III–EXAMINATION (Remedial)– WINTER 2015

Subject code: 730801 **Date: 04/12/2015**

Subject Name: Engineering Optimization

Time: 2:30 PM to 5:00 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)** What is Optimization? Explain Classification of Optimization. **07**

(b) Compare Genetics Algorithm and Simulated Annealing methods of optimization. **07**

Q.2 **(a)** A scaffolding system consists of three beams and six ropes as shown in figure 1. Each of the top ropes *A* and *B* can carry a load of W_1, each of the middle ropes C and *D* can carry a load of W_2, and each of the bottom ropes *E* and *F* can carry a load of W_3. If the loads acting on beams 1, 2, and 3 are x_1, x_2, and x_3, respectively as shown in Fig. 1. Formulate the problem of finding the maximum load($x_1 + x_2 + x_3$) that can be supported by the system. Assume that the weights of the beams 1, 2, and 3 are w_1, w_2, and w_3, respectively, and the weights of the ropes are negligible. **07**

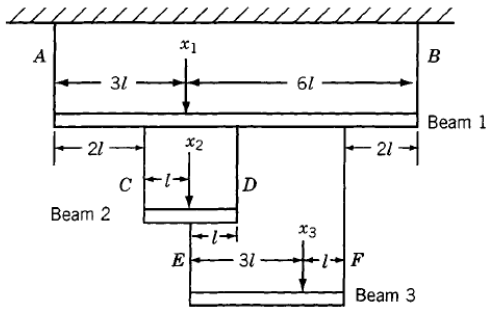

Figure 1.0 Scaffolding system with three beams

(b) Discuss the deterministic and stochastic programming problems with examples. **07**

OR

(b) What is Hessian matrix? Explain the characteristics of Hessian Matrix? **07**

Q.3 **(a)** Explain random search methods for unconstrained minimization problem **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 $X_1 = \begin{Bmatrix} 0 \\ 0 \end{Bmatrix}$ for a three iterations using steepest Descent Method. **07**

OR

Q.3 **(a)** Explain the internal halving method in detail. **07**

(b) Find the minimum of $f(x) = x(x-1.5)$ in the interval (0.0, 1.00) to within 10% of the exact value by using dichotomous search. Take δ =0.001and L_0=1.0 **07**

Q.4 **(a)** Explain interior penalty function method of optimization. **07**

(b) Explain with the help of a sketch an iterative process of cubic interpolation method. **07**

OR

Q.4 **(a)** Enlist unconstrained optimization methods. Explain only features of any two closely related methods. **07**

(b) Explain Golden section method. **07**

Q.5 **(a)** Explain in brief the differences and similarities between genetic algorithms and traditional methods. **07**

(b) A total length of 100 m of tubes must be installed in a shell and tube heat exchanger in order to provide the necessary heat transfer area. The total cost of the installation in rupees includes 1.The cost of the tubes which is constant at Rs 900; 2. The cost of the shell $=1100D^{2.5}L$; 3.The cost of floor space occupied by the heat exchanger =320 DL where L is the length of the heat exchanger and D is the diameter of the shell, both in meter. The spacing of the tubes is such that 200 tubes will fit in a cross sectional area of 1.0 m^2 in the shell. Determine the diameter and length of the heat exchanger for minimum first cost. **07**

OR

Q.5 **(a)** Explain MATLAB Functions for Solving Optimization Problems in MATLAB Optimization Toolbox. **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**

****