Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – III • EXAMINATION – SUMMER • 2014

Subject code: 730801 **Date: 03-06-2014**

Subject Name: Engineering Optimization

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)** Explain Objective Function and objective function surfaces. **07**

(b) 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**

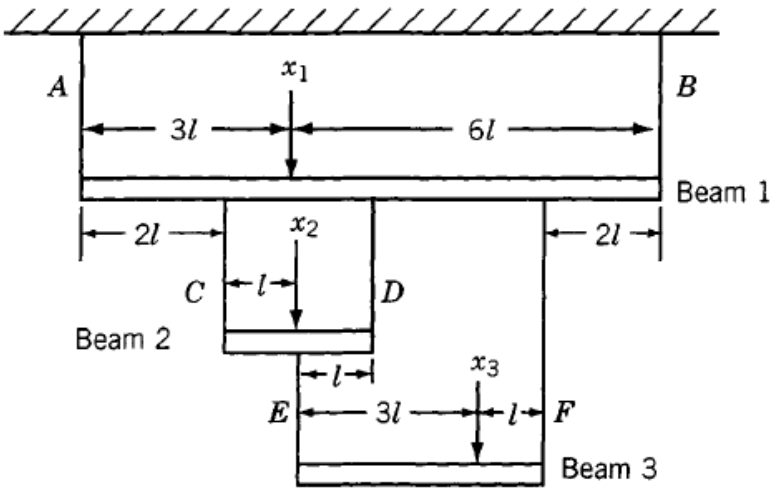

Figure 1[Question No. 1(b)].

Q.2 **(a)** Discuss the deterministic and stochastic programming problems with examples. **07**

(b) A rectangular box of height "a" and width 'b" is placed adjacent to a wall. Find the length of the shortest ladder that can be made to lean against the wall. **07**

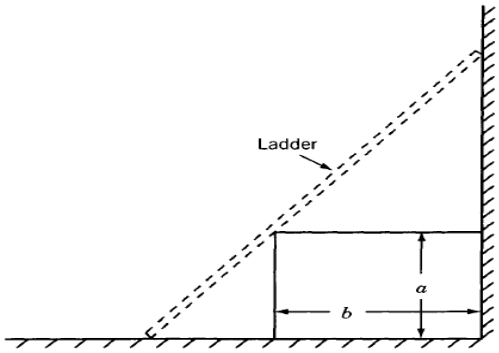

Figure 2 [Question No. 2(b)].

OR

(b) Minimize of $f(x) = \frac{2000}{x} + 2\pi x^2$ in the interval [0, 10] using interval of uncertainty or Fibonacci method for two iterations. Take value of n=7 **07**

Q.3 **(a)** Explain the types of unimodal functions and its outcome in detail. **07**

(b) Minimize $f(x) = 2x^4 - x^3 + 5x^2 - 12x + 1$ using quadratic interpolation method. **07**
For the range of [0,1]. Carry out at least two intervals.

OR

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

(b) Explain Newton-Raphson method and minimize $f(x) = 2x^4 - x^3 + 5x^2 - 12x + 1$ using **07**
Newton-Raphson method with starting point $x_0 = 0.0$. Use ε=0.01

Q.4 **(a)** Explain with the help of a sketch an iterative process of cubic interpolation method. **07**

(b) Minimize $f(x) = x_1 - x_2 + 2x_1^2 + 2x_1x_2 + x_2^2$, with starting point $x_0 = [0,0]^T$& probing **07**
step length $\epsilon = 0.01$ using univariate method for two iterations.

OR

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

(b) Minimize $f(x) = x_1^{\,2} + 2x_2^{\,2} - 4x_1 - 2x_1x_2$ with starting point $x_0 = [0,0]^T$ using steepest descent method for two iterations. **07**

Q.5 **(a)** Discuss complementary Geometric Programming and explain degree of difficulty. **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**

OR

Q.5 **(a)** Explain the main features of genetic algorithms in brief. **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 $1m^2$ in the shell. Determine the diameter and length of the heat exchanger for minimum first cost. **07**

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