Enrolment No.

Date: 09/07/2012

**Total Marks: 70** 

# **GUJARAT TECHNOLOGICAL UNIVERSITY**

## M.E -I<sup>st</sup> SEMESTER-EXAMINATION - JULY- 2012

Subject code: 710903N

**Subject Name: Engineering Optimization** 

Time: 2:30 pm – 05:00 pm

# **Instructions:**

- 1. Attempt all questions.
- 2. Make suitable assumptions wherever necessary.
- 3. Figures to the right indicate full marks.
- (a) Design a tank for minimum surface area. The tank is closed at both the 07 **Q.1** ends and is required to have the volume V. The radius R and height H are to be selected as the design variables. Assume simplified objective function as  $f(X)=R^2+RH$ .
  - (b) Define : Explain necessary and sufficient conditions for the optimization 07 problem for the following conditions
    - 1. Optimization problem containing single variable
    - 2. Optimization problem containing multi variables
- (a) Find the solution for the following problem using Lagrangian method: Q.2 07  $f(x,y)=Kx^{-1}y^{-2}$  subjected to  $g(x,y)=x^{2}+y^{2}-A^{2}=0$ . Where, K and A are constants. 07
  - (b) State the difference between following entities
    - 1. Continuous variable and discrete variables
    - 2. Single objective optimization and multi objective optimization
    - 3. Quadratic programming and geometric programming

### OR

(b) Explain the significance of saddle point for multivariable optimization 07 problem with an appropriate example.

#### Q.3 (a) Explain step wise procedure for the Fibonacci method. 07

(b) Derive the optimal solutions from the Kuhn-Tucker conditions for the 07 following problem: Minimize  $f(X)=2x_1+3x_2-x_1^2-2x_2^2$  subjected to:  $x_1+3x_2 \le 6$ ,  $5x_1+2x_2 \le 10$ ,  $x_1 \ge 0, x_2 \ge 0.$ 

### OR

- (a) Explain step wise procedure for golden section method Q.3 07 Minimize  $f(X) = x_1^2 + x_2^2$ , subjected to :  $x_1 + x_2 \ge 4$ ,  $2x_1 + x_2 \ge 5$ ,  $x_1 \ge 0$ ,  $x_2 \ge 0$ (b) 07
  - using Kuhn-Tucker conditions.
- Q.4 (a) What do you understand by a gradient of a function. Explain its 07 significance in the field of optimization.
  - (b) Solve following optimization problem using Cauchy method 07 Minimize  $f(X)=x_1-x_2+2x_1^2+2x_1x_2+x_2^2$  by assuming starting point as (0,0). OR
- (a) Differentiate between Primal and Dual expressions (with mathematical 07 0.4 expressions) for less than equalities used for geometric programming.
  - (b) What do you understand by 'penalty method'? Which are the different 07 penalty function methods? Explain any one in detail.

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