

**GUJARAT TECHNOLOGICAL UNIVERSITY****ME Semester –III Examination Dec. - 2011****Subject code: 730403****Date: 08/12/2011****Subject Name: Optimization technique****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 the Steepest descent method Unconstrained optimization methods in detail. **07**
- (b) Enumerate few engineering applications of optimization. **07**

- Q.2** (a) Draw the flow chart for finding the optimal solution by the simplex algorithm. **07**
- (b) By using an interior penalty function method solve the following Problem. **07**

$$g(x) = -(-x_1 - 1)^2 + (x_2 + 5)^2$$

Subjected to

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

$$-(x_1 - 2)^2 + x_2 - 3 \leq 0$$

**OR**

- (b) State and explain the generalized representation of exterior penalty function method. **07**

- Q.3** (a) Find the minimum of  $6e^{-2x} + 2x^2$  by each of the following procedures: **07**
- a. Golden Section Method
  - b. Newton's Method
  - c. Bisection Search Method
- (b) For the uniform search method and Fibonacci search method, compute the number of functional evaluations required for  $\alpha = 0.1, 0.01, 0.001$  and  $0.0001$ , where  $\alpha$  is the ratio of final interval of uncertainty to the length of the initial interval of the uncertainty. **07**

**OR**

- Q.3** (a) Solve the problem to maximize  $3x_1 + x_2 + 6x_1x_2 - 2x_1^2 + 2x_2^2$  by the method of Hooke and Jeeves **07**
- (b) Solve the problem to minimize  $2x_1^2 + 3x_2^2 + e^{2x_1^2 + x_2^2}$ , starting with the point (1, 0) and using BFGS quasi Newton method. **07**

- Q.4** (a) Consider the following linear program: **07**

Maximize  $x_1 + 3x_2$  subject to

$$2x_1 + 3x_2 \leq 6$$

$$-x_1 + 4x_2 \leq 4$$

$$x_1, x_2 \geq 0$$

- a. Write KKT optimality conditions
- (b) For above given data, verify whether or not the KKT conditions hold true, both algebraically and geometrically. From this, find an optimal **07**

OR

- Q.4** (a) Consider the following problem: **07**  
 Maximize  $(x_1 - 2)^2 + (x_2 - 3)^2$  subject to  
 $3x_1 + 2x_2 \geq 6$   
 $-x_1 + x_2 \leq 3$   
 $x_1 \leq 2$   
 Graphically, find all locally maximizing solutions. What is the global maximum for this problem?
- (b) For above data, repeat part a analytically, using first and second order KKT optimality conditions along with any other formal optimality characterization. **07**

- Q.5** (a) Discuss in detail: **07**  
 a. Weierstrass's Theorem  
 b. Farkas's Theorem
- (b) Consider the linear program to minimize  $c^T x$  subjected to  $Ax = b, x \geq 0$ . Write the dual problem. Show that the dual of the dual problem is equivalent to the primal problem. **07**

OR

- Q.5** (a) Discuss in detail: **07**  
 a. Gordan's Theorem  
 b. Optimality conditions in Linear Programming
- (b) Let A be an  $m \times m$  matrix. Using farkas's theorem, prove that exactly one of the following two systems has solution. **07**  
 System 1:  $Ax > 0$   
 System 2:  $A^T y = 0, y \geq 0, y \neq 0$

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