Seat No.: _____ Enrolment No._____

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 $6e^{-2\lambda} + 2\lambda^2$ 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 α is the ration 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**

solution

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 $m X m$ 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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