Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. Sem. – II[nd] - Examination – June/July- 2011

Subject code: 1722905

Subject Name: Optimization Techniques

Date:27/06/2011 **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)** For each of the following functions : **06**
(i) $f(x) = 3x^2$ (ii) $f(x) = 2x$ (iii) $f(x) = 2x^2 - x^3$
Determine if f(x) is convex, concave, strictly convex, strictly concave , all or none of these classes in the range $-\infty \leq x \geq \infty$.

(b) Does the following set of constraints that form a closed region form a convex region? **08**

$$-x_1^2 + x_2 \geq 1$$
$$x_1 - x_2 \geq -2$$

Comments on the result obtained.

Q.2 **(a)** Discuss the utility of optimization techniques in Power Electronics Engineering field. **07**

(b) Why are engineers interested in optimization? State procedure for solving optimization problems. **07**

OR

(b) State necessary and sufficient conditions for stationary points. Sketch the curve $f(y) = y^4$. Find the stationary points. **07**

Q.3 **(a)** Minimize a quadratic function $f(x) = x^2 - x$ using **07**
(A) Newton's method and (B) Finite difference – Newton method. Also, plot f(x).

(b) State methods that uses function values only for unconstrained multivariable optimization. Describe any two methods. **07**

OR

Q.3 **(a)** Minimize the non - quadratic function $f(x) = x^4 - x + 1$ using Quasi – Newton method. Also, sketch f(x). **07**

(b) Use simplex method to find the optimal solution of following LPP, **07**

$$\text{Max } Z = 107x_1 + x_2 + 2x_3$$

Subject to the constraints

$$14x_1 + x_2 - 6x_3 + 3x_4 = 7$$
$$16x_1 + x_2 - 6x_3 \leq 5$$
$$3x_1 - x_2 - x_3 \leq 0$$

and $x_1, x_2, x_3, x_4 \geq 0$

Q.4	**(a)**	State and explain the Kuhn -Tucker necessary conditions.	**07**
	(b)	Define the following type of problems: (i) Integer programming (ii) Dynamic programming (iii) Geometric programming.	**03**
	(c)	Explain the significance of post optimal analysis of a simplex LP problem.	**04**

OR

Q.4	**(a)**	Use the dual simplex method to solve the following LPP. Min Z = $3x_1 + x_2$ Subject to constraints $x_1 + x_2 \geq 1$ $2x_1 + 3x_2 \geq 2,$ Where $x_1 \geq 0, x_2 \geq 0$	**07**
	(b)	How does simplex algorithm indicate that: (i) There is an alternate optimal solution? (ii) The problem has no feasible solution? (iii) The problem has unbounded optimal solution?	**03**
	(c)	Discuss the method of bracketing the minimum of a uni-dimensional function in a defined interval.	**04**
Q.5	**(a)**	Discuss GRG algorithm.	**07**
	(b)	Discuss Quadratic Programming for NLP.	**07**

OR

Q.5	**(a)**	Using line search and QP sub - problem QP (x, B), develop a typical SQP algorithm.	**07**
	(b)	Why stochastic programming is required? Explain stochastic programming with a suitable example.	**07**

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