Seat No.: ________ Enrolment No.___________

GUJARAT TECHNOLOGICAL UNIVERSITY

ME - SEMESTER–1 • EXAMINATION – WINTER 2014

Subject Code: 2710310 **Date:06/01/ 2015**

Subject Name: Optimization Techniques for Engineers

Time: 2:30PM to 5:00PM **Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Use two phase simplex method to solve **07**

$$Maximize\ Z = 5x_1 - 4x_2 + 3x_3$$
$$subject\ to\ 2x_1 + x_2 - 6x_3 = 20;$$
$$6x_1 + 5x_2 + 10x_3 \le 76;$$
$$8x_1 - 3x_2 + 6x_3 \le 50;$$
$$x_1, x_2, x_3 \ge 0$$

(b) Use penalty method to solve the following LPP: **07**

$$Minimize\ \ Z = 5x + 3y$$
$$Subject\ to\ 2x + 4y \le 12;$$
$$2x + 2y = 10;$$
$$5x + 2y \ge 10;$$
$$x, y \ge 0$$

Q.2 **(a)** Find the maximum of $Z = 6x + 8y$ **07**

$$subject\ to\ 5x + 2y \le 20;$$
$$x + 2y \ge 10;$$
$$x, y \ge 0$$

By solving its dual problem.

(b) Minimize the following function using cubic search method (up to only two iteration). **07**

$$f(x) = x^2 + \frac{54}{x}$$

(b) Minimize the following function using successive quadratic estimation method (up to only two iteration). **07**

$$f(x) = x^2 + \frac{54}{x}$$

Q.3 **(a)** Minimize the following function using Exhaustive search method (up to only two iteration). **07**

$$f(x) = x^2 + \frac{54}{x}$$

(b) Minimize $(x_1, x_2) = x_1 - x_2 + 2x_1^2 + 2x_1x_2 + x_2^2$, using random walk method from the point $X_1 = \begin{pmatrix} 0.0 \\ 0.0 \end{pmatrix}$ with a starting step length of λ=1.0 . Assume suitable data necessary to solve the problem (up to only two iteration). **07**

Q.3 **(a)** Minimize the following function using Interval halving method (up to only **07**

two iteration).

$f(x) = x^2 + \frac{54}{x}$

(b) Minimize $(x_1, x_2) = 100(x_2 - x_1^2)^2 + (1 - x_1)^2$, using random walk method from the point $X_1 = \begin{pmatrix} -1.2 \\ 1.0 \end{pmatrix}$ with a starting step length of λ=1.0 . Assume suitable data necessary to solve the problem (up to only two iteration). **07**

Q.4 (a) Minimize $(x_1, x_2) = x_1 - x_2 + 2x_1^2 + 2x_1x_2 + x_2^2$, using Univariate method from the point $X_1 = \begin{pmatrix} 0.0 \\ 0.0 \end{pmatrix}$. Assume suitable data necessary to solve the problem (up to only two iteration). **07**

(b) Minimize $(x_1, x_2) = x_1 - x_2 + 2x_1^2 + 2x_1x_2 + x_2^2$, using Powell's method from the point $X_1 = \begin{pmatrix} 0.0 \\ 0.0 \end{pmatrix}$. Assume suitable data necessary to solve the problem (up to only two iteration). **07**

Q.4 (a) Minimize $(x_1, x_2) = x_1 - x_2 + 2x_1^2 + 2x_1x_2 + x_2^2$, using Hooke and Jeeves' method from the point $X_1 = \begin{pmatrix} 0.0 \\ 0.0 \end{pmatrix}$. Assume suitable data necessary to solve the problem (up to only two iteration). **07**

(b) Discuss Rosenbrock's algorithm to find optimal solution for unconstrained problem with suitable example. **07**

Q.5 (a) Minimize $f(x) = (x_1^2 + x_2 - 11)^2 + ([x_1 + x_2^2 - 7)]^2$ **8**

Subject to $g_1(x) = 26 - (x_1 - 5)^2 - x_2^2 \geq 0,$

$g_2(x) = 20 - 4x_1 - x_2 \geq 0, x_1, x_2 \geq 0$

Using Generalized Reduced Gradient Method from the initial point $x_1^{(0)}$=1 and $x_2^{(0)}$=2. Assume suitable data necessary to solve the problem (up to only one iteration).

(b) Give explanation on Genetic algorithm with suitable example. **06**

Q.5 (a) Minimize $f(x) = (x_1^2 + x_2 - 11)^2 + ([x_1 + x_2^2 - 7)]^2$ **08**

Subject to $g_1(x) = 26 - (x_1 - 5)^2 - x_2^2 \geq 0,$

$g_2(x) = 20 - 4x_1 - x_2 \geq 0, x_1, x_2 \geq 0$

Using Gradient Projection Method from the initial point $x_1^{(0)}$=0 and $x_2^{(0)}$=0. Assume suitable data necessary to solve the problem (up to only one iteration).

(b) Give explanation on Variational approach to solve optimal control problem. **06**