Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME – SEMESTER I (NEW) – • EXAMINATION – SUMMER 2016

Subject Code: 2710310 **Date:16/05/2016**

Subject Name: Optimization Techniques for Engineers

Time:02:30 pm to 05:00 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)** Bracket the minimum of the function $f(x) = x^2 + 54/x$ using bounding phase method. Take $a = 0$, $b = 5$ and $n = 3$. **07**

(b) Explain the genetic algorithm. **07**

Q.2 **(a)** Apply Powell's conjugate direction method to the following function starting from (0, 4). Assume suitable data necessary to solve the problem (up to only two iteration). **07**

$$f(x, y) = 2x^2 - 2xy + y^2 + 2x - 2y$$

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

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

OR

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

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

Q.3 **(a)** Explain algorithm for exhaustive search method. **06**

(b) Compute two iteration of Hooke-Jeeves search method starts with $x_1 = (0, 0)$ to minimize following function: **08**

$$f(x) = (x_1^2 + x_2 - 11)^2 + (x_2^2 + x_1 - 7)^2$$

OR

Q.3 **(a)** Explain algorithm for bisection method. **06**

(b) Minimize $f(x) = (x_1^2 + x_2 - 11)^2 + (x_2^2 + x_1 - 7)^2$, using Fletcher-Reeves method. Assume suitable data necessary to solve the problem (up to only two iteration). **08**

Q.4 **(a)** Solve the problem using simplex method: **07**

$$\begin{aligned} &\text{Maximize } p = 5x + 4y + 3z \\ &\text{Subject to } x + y + z \le 30, \\ &\qquad 2x + y + 3z \le 60, \\ &\qquad 3x + 2y + 4z \le 84, \\ &\qquad x, y, z \ge 0. \end{aligned}$$

(b) Solve the problem using graphical method: **07**

Maximize $z = 3x + 2y$

Subject to $2x + y \le 18$,

$2x + 3y \le 42$,

$3x + y \le 24$,

$x, y \ge 0$.

OR

Q.4 **(a)** Solve the following using penalty method: **06**

Minimize $z = 0.4x_1 + 0.5x_2$

Subject to $0.3x_1 + 0.1x_2 \le 2.7$,

$0.5x_1 + 0.5x_2 = 6$,

$0.6x_1 + 0.4x_2 \ge 6$,

$x_1, x_2 \ge 0$.

(b) Minimize: $f(x) = (x_1^2 + x_2 - 11)^2 + (x_2^2 + x_1 - 7)^2$ **08**

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

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

$x_1, x_2 \ge 0$.

Using Gradient Projection 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).

Q.5 **(a)** Explain Kuhn-Tucker conditions. **07**

(b) Draw a flowchart of the optimal design procedure and give brief explanation. **07**

OR

Q.5 **(a)** Explain in details about design variables of optimization problem. **07**

(b) Explain the similarity between genetic algorithm and traditional Methods. **07**

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