

**GUJARAT TECHNOLOGICAL UNIVERSITY**  
**ME - SEMESTER– I (New course)• REMEDIAL EXAMINATION – SUMMER 2015**

**Subject Code: 2710310****Date:12/05/2015**Subject Name: **Optimization Techniques for Engineers****Time: 10:30 am to 1:00 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 exhaustive search method. Take  $a = 0$ ,  $b = 5$  and  $n = 3$ . **07**

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

$$\text{Maximize } z = 2x_1 - 3x_2 + 4x_3$$

$$\text{Subject to } 4x_1 - 3x_2 + x_3 \leq 3,$$

$$x_1 + x_2 + x_3 \leq 10,$$

$$2x_1 + x_2 - x_3 \leq 10,$$

$$x_1, x_2, x_3 \geq 0.$$

**Q.2 (a)** Apply steepest descent method to the following function starting from (0,0). **07**

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

**(b)** Minimize the following function using successive quadratic estimation 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)** Give explanation on Variational approach to solve optimal control problem. **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 secant method. **06**

**(b)** Minimize  $f(x) = (x_1^2 + x_2 - 11)^2 + (x_2^2 + x_1 - 7)^2$ , using Powell's method from the point  $x_1 = (0, 0)$ . Assume suitable data necessary to solve the problem (up to only two iteration). **08**

- Q.4 (a)** Reddy Mikks produces both interior and exterior paints from two raw materials,  $M1$  and  $M2$ . The following table provides the basic information about production. **06**

	Tons of raw material per ton of		Maximum daily availability (tons)
	Exterior paint	Interior paint	
Raw Material $M1$	6	4	24
Raw Material $M2$	1	2	6
Profit per ton (in thousands)	5	4	

A market survey indicates that the daily demand for interior paint cannot exceed that for exterior paint by more than 1 ton. Also, the maximum daily demand for interior paint is 2 tons. Reddy Mikks wants to determine the optimum product mix of interior and exterior paints maximizes the total daily profit. Apply graphical method to find the optimum solution.

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

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

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

$$x_1, x_2 \geq 0.$$

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).

**OR**

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

$$\text{Minimize } z = 4x_1 + x_2$$

$$\text{Subject to } 3x_1 + x_2 = 3,$$

$$4x_1 + 3x_2 \geq 6,$$

$$x_1 + 2x_2 \leq 4,$$

$$x_1, x_2 \geq 0.$$

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

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

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

$$x_1, x_2 \geq 0.$$

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

- Q.5 (a)** Explain the genetic algorithm. **07**

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

**OR**

- Q.5 (a)** Explain in details about variable bound of optimization problem. **07**

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

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