Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME – SEMESTER-1 (NEW) EXAMINATION – WINTER 2016

Subject Code: 2710310 **Date:03/01/2017**

Subject Name: Optimization Techniques for Engineers

Time: 2:30 pm to 5:00 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 manufacturer is engaged in producing 2 products X and Y, the contribution margin being $ 15 and $ 45 respectively. A unit of product X requires 1 unit of facility A and 0.5 unit of facility B. A unit of product Y requires 1.6 units of facility A, 2.0 units of facility B and 1 unit of raw material C. The availability of total facility A, B and raw material C during a particular time period are 240,162 and 50 units respectively. Find out the product mix which will maximize the contribution margin by simplex method. **14**

Q.2 A Minimize following function using Cubic search method. Initial point is 1, step size is 0.5 and termination parameter is 0.001. **07**

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

B Maximize $Z = 2X_1 + X_2 + 3X_3$ using Big-M method. **07**

Subject to $X_1 + X_2 + 2X_3 \leq 5$

$2X_1 + 3X_2 + 4X_3 = 12$

$X_1, X_2, X_3 \geq 0$

OR

B Maximize $Z = -4X_1 - 3X_2 - 9X_3$ using two phase method. **07**

Subject to $2X_1 + 4X_2 + 6X_3 \geq 15$

$6X_1 + X_2 + 6X_3 \geq 12$

$X_1, X_2, X_3 \geq 0$

Q.3 Minimize $f(x_1, x_2) = x_1 - x_2 + 2x_1^2 + 2x_1x_2 + x_2^2$ using Fletcher–Reeves Method. Assume Initial point (x_1, x_2) is (0,0) **14**

OR

Q.3 Minimize $f(x_1, x_2) = x_1 - x_2 + 2x_1^2 + 2x_1x_2 + x_2^2$ using Rosen broke's Method. Assume Initial point (x_1, x_2) is (0,0), (expansion factor α=3.0, contraction factor β= 0.5), step size λ1=0.8 and λ2=0.8. (minimum three iteration) **14**

Q.4 Minimize $f(x_1, x_2) = (x_1^2 + x_2 - 11)^2 + (x_1 + x_2^2 - 7)^2$ **14**

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

$g_1(x_1, x_2) = 20 - 4x_1 - x_2 \geq 0$

$(x_1, x_2 \geq 0)$, Assume Initial point $(x_1 0 \quad , x_2 0 \quad)$ is (1,2).

Lower bound of (x_1, x_2) is (0,0) and Upper bound of (x_1, x_2) is (5,5).

Use Generalized Reduced Gradient (GRG) algorithm.

OR

Q.4 Minimize $f(x_1, x_2) = (x_1^2 + x_2 - 11\ )^2 + (x_1 + x_2^2 - 7\ )^2$ **14**

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

$g_1(x_1, x_2) = 20 - 4x_1 - x_2 \geq 0$

$(x_1, x_2\ \geq 0)$, Assume Initial point $\left(x_1 0\ \ , x_2 0\ \ \right)$ is (0,0).

Use Gradient Projection technique.

Q.5 Discuss about the Genetic Algorithm in detail with following example. **14**

Minimize $f(x_1, x_2) = (x_1^2 + x_2 - 11\ )^2 + (x_1 + x_2^2 - 7\ )^2$

Lower bound of (x_1, x_2) is (0,0) and Upper bound of (x_1, x_2) is (6,6).

OR

Q.5 **A** Discuss about Variational approach to optimal control problem and also define Hamiltonian in detail. **07**

B Discuss about Box complex algorithm for multivariable constraint optimization in detail. **07**

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