Seat No.: _____ *Enrolment No._____*

GUJARAT TECHNOLOGICAL UNIVERSITY

ME - SEMESTER–I(New course)• EXAMINATION – WINTER- 2015

Subject Code: 2712704 **Date: 02/01/2016**

Subject Name: First Course in Optimization Techniques

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) Give and explain the standard statement of optimization problem. Define concept of constraint surface with necessary figure. [7]

(b) List five engineering applications of optimization. A manufacturing firm produces two products, A and B, using two limited resources. The maximum amounts of resources 1 and 2 available per day are 1000 and 250 units, respectively. The production of 1 unit of product A requires 1 unit of resource 1 and 0.2 unit of resource 2, and the production of 1 unit of product B requires 0.5 unit of resource 1 and 0.5 unit of resource 2. The unit costs of resources 1 and 2 are given by the relations ($0.375-0.00005u_1$) and ($0.75-0.0001u_2$), respectively, where u_1 and u_2 denotes the number of units of resource i used (i=1, 2). The selling prices per unit of products A and B, P_A and P_B, are given by [7]

$P_A = 2.00 - 0.0005X_A - 0.00015X_B$; $P_B = 3.50 - 0.0002X_A - 0.0015X_B$

Where X_A and X_B indicate, respectively, the number of units of products A and B sold. Formulate the problem of maximizing the profit assuming that the firm can sell all the units it manufactures.

Q.2

(a) Maximize $f = 4x_1 - x_2 + 2x_3$ subject to $2x_1 + x_2 + 2x_3 \le 6$; $x_1 - 4x_2 + 2x_3 \le 0$; $5x_1 - 2x_2 - 2x_3 \le 4$; $x_1, x_2, x_3 \ge 0$ using simplex algorithm. [10]

(b) Find maxima and minima , if any, of the function $f(x) = 4x^3 - 18x^2 + 27x - 7$ [4]

OR

(b) Minimize $f(x, y) = kx^{-1}y^{-2}$ subject to $g(x, y) = x^2 + y^2 - a^2 = 0$ using Lagrange multiplier method. [4]

Q.3

(a) Define (i) integer programming problem (ii) Linear programming problem(iii) quadratic programming problem [7]

(b) Explain the necessary and sufficient condition of single variable optimization. [7]

OR

Q.3

(a) Explain the Kuhn-Tucker conditions. [7]

(b) Explain the transportation problem and basic steps involved in the solution of transportation problem. [7]

Q.4

(a) Explain the Fletcher-Reeves method and minimize $f(x_{1,}x_2) = x_1 - x_2 + 2x_1^2 + 2x_1x_2 + x_2^2$ starting from point $X_1 = \begin{Bmatrix} 0 \\ 0 \end{Bmatrix}$ [7]

(b) Describe constraint optimization technique: Random Search Method. [7]

OR

Q.4

(a) Describe classical optimization techniques. [7]

(b) Explain Newton's method and show that the Newton's method finds the minimum of a quadratic function in one iteration. [7]

Q.5

(a) List various search methods and explain Dichotomous search method. [7]

(b) Explain quasi-newton method and secant method. [7]

OR

Q.5

(a) What is one-dimensional minimization problem? State difference between elimination and interpolation methods. [7]

(b) Explain quadratic interpolation method. [7]