Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

ME Semester –III Examination Dec. - 2011

Subject code: 733001 **Date: 05/12/2011**

Subject Name: Advance Process Optimization

Time: 10.30 am – 01.00 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 chemical plant manufacturer finds that there is a high demand for two of his products, A and B. How much should he produce of each? Obviously, as much as he is capable. However, he is faced with the problem that only limited supplies of his two raw materials, α and β, are available. Both raw materials are necessary in the production of his products. What should be the production rate of each of his products under the limitation of a limited raw material supply if he wishes to make a maximum profit? **14**

Data:

Rate of consumption of raw material α per unit rate of production of A is 1.

Rate of consumption of raw material α per unit rate of production of B is 1.

Rate of consumption of raw material β per unit rate of production of A is 2.

Rate of consumption of raw material β per unit rate of production of B is 1.

Maximum available rate of supply of A is 3 and B is 4 tone/month.

Net profit from sale of one tone quantity of A is Rs 3 lac and B is 2 lac.

Set up a mathematical model for the system and find the solution of the problem using Simplex Method of linear programming.

Q.2 **(a)** Find the minimum of the function, **07**

$$y = 4x_1^2 + 5x_2^2$$

subject to,

$$2x_1 + 3x_2 = 6$$

Use Penalty Function method.

(b) The safe distance, in feet, between automobile (center to center) on a certain highway has been found experimentally to be, **07**

$$L = 30 + 0.07\, V^{3/2}$$

with $40 \leq V \leq 70$. Here, V is the speed of the car in miles per hour. Find the safe maximum capacity of the highway per lane.

OR

(b) A length of wire is to be cut into two parts. One portion is to be bent into the form of a circle, and the other into the form of a square. In what ratio must the wire be cut if the sum of the areas enclosed by the circle and the square is the least possible? **07**

Q.3 **(a)** Apply the following sequential one-dimensional search techniques to reduce the interval of uncertainty for the maximum of the function $f = 6.64 + 1.2x - x^2$ from [0,1] to less than 2 percent of its original size. Show all the iterations for the following search methods: **07**

(i) Two-point equal interval
(ii) Golden Section Search
(iii)Dichotomus Search
(iv)Fibonacci Series method

(b) Find the values of x_1 and x_2 which minimize the function, **07**

$$y = x_1^2 + 4x_2^2 - 4x_1$$

subject to the restriction that,

$$2x_2 - x_1 = 12.$$

Use Lagrangian Multiplier method.

OR

Q.3 Show that the stationary points of **14**

$$y = x_1^2 + x_2^2$$

subject to,

$$g = x_1 + x_2^2 - 5 = 0$$

consists of two minima and one maxima. Then show that

$$F = y + \lambda g$$

has one saddle point and two minima for unconstrained variations about the three stationary points.

Q.4 **(a)** Discuss Ant Colony Optimization. **07**

(b) Discuss Genetic Algorithm. **07**

OR

Q.4 Find the minimum of the objective function $y = x_1^2 + 3x_2^2 + 5x_3^2$ starting from the point {1,6,-7} and using the Powell's method. Analytical methods may be used to locate the one-dimensional optima. **14**

Q.5 **(a)** Write a short note on: Artificial Neural Network. **07**

(b) Discuss optimization of Liquid-Liquid Extraction process. **07**

OR

Q.5 **(a)** Find the values of t_1 and t_2 for the function **05**

$$y = (4/t_1t_2) + (3t_2^{-2}) + (4t_1t_2^2)$$

using geometric programming.

(b) The original problem is to find the minimum of the function **09**

$$y = 3x_1 + 5x_2$$

subject to the restriction,

$$x_1 + 3x_2 \geq 14$$
$$2x_1 - x_2 \geq 2$$
$$x_1 - 4x_2 \leq 2$$
$$x_1 + x_2 \leq 20$$

with $x_1 \geq 0$ and $x_2 \geq 0$

Construct the dual for this problem and solve it.

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