Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – II • EXAMINATION – WINTER 2012

Subject code: 1721602 **Date: 31-12-2012**

Subject Name: Chemical Process Optimization

Time: 10.30 am – 01.00 pm **Total Marks: 70**

Instructions:

1. **Attempt any five questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 (a) Find the specification of an open-topped rectangular tank whose total area is to be 108 m^2, if a maximum volume is required. **08**

(b) Write necessary any sufficient conditions for an extreme value of multivariable objective function. **06**

Q.2 (a) An open top box is to be made out of a piece of cardboard measuring 2m X 3m by cutting off equal surfaces from the corners and turning up the side. Find dimensions of the box for maximum volume. **07**

(b) Explain concept and working of Ant colony optimization technique. **07**

OR

(b) Explain the algorithm of simulated annealing optimization technique. **07**

Q.3 (a) Find the value of x in the interval (0,1), which minimizes the function $f = x(x-1.5)$ with accuracy of ± 0.05 using Golden Section search technique. **07**

(b) Minimize function $f(x) = 100(x_2 - x_1^2)^2 + (1 - x_1^2)$ with an initial point of (-1.2, 1.0) using Rosenbrock - method up to two iterations. **07**

OR

Q.3 (a) Using the method of Lagrangian multipliers find the minimum of $y = 4x_1^2 + 5x_2^2$ subject to $2x_1 + 3x_2 = 6$. **07**

(b) Explain concept of region elimination methods and compare performance of different region elimination methods. **07**

Q.4 (a) A liquid phase, isothermal, reversible first order, exothermic reaction **07**

$$A \underset{k_2}{\overset{k_1}{\rightleftharpoons}} B$$

is to be carried out in a CSTR. The reactor space time is to be held constant at space time τ. The feed is pure A. Show that the choice of optimum temp which will maximize conversion of A is the one which will maximize $k_1\tau / 1 + k_2\tau$.

(b) Explain Sequential Simplex technique. **07**

OR

Q.4 (a) Find the minimum of $y = \frac{2}{x_1 x_2} + \frac{3}{x_2} + 4x_1 x_2^2$ using geometric programming and also find the location of minimum. **07**

(b) Explain the Complex method of Box with example. **07**

Q.5 (a) Explain the interpretations with examples for **07**

- Zero coefficient in column.
- No positive ratio.
- Identical values of smallest positive ratio.

while solving any linear programming problem using simplex method.

(b) Explain the basics of population based search techniques and discuss working of Genetic Algorithm for optimization. **07**

OR

Q.5 A manufacturer requires an alloy consisting of 40 % tin, the remainder being made up of lead and zinc in equal proportions. This alloy can be made up by mixing a number of available tin-lead-zinc alloys, the properties and cost of which are tabulated below. Find the cost of the chipset blend and the amount of each type of alloy which should be purchased per unit weight of alloy produced. **14**

		Available alloys				
		1	2	3	4	5
Analysis	% lead	10	10	40	60	30
	% zinc	10	30	50	30	30
	% tin	80	60	10	10	40
Cost	Rs / kg	41	43	58	60	76

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