

GUJARAT TECHNOLOGICAL UNIVERSITY**M.E Sem-II Examination July 2010****Subject code:721602****Subject Name: Chemical Process Optimization****Date: 06 /07 /2010****Time: 11.00am – 1.30pm****Total Marks: 60****Instructions:**

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

- Q.1 (a)** Define a suitable search region and a feasible initial base point for the complex method of search in minimizing $y = 4x_1 + x_2 + 2x_3$ subject to the restrictions that $x_i \geq 0$ and **06**

$$x_1 + x_2 + x_3 \leq 6$$

$$5x_1 - x_2 + x_3 \leq 4$$

$$x_1 + 3x_2 + 2x_3 \geq 1$$

Setup a complex method of search and carryout three cycles of search.

- (b)** Write necessary any sufficient conditions for an extreme value of multivariable objective function and find out stationary point for **06**

$$y = 1 + 8x + 2x^2 - \frac{10}{3}x^3 - \frac{1}{4}x^4 + \frac{4}{5}x^5 - \frac{1}{6}x^6$$

- Q.2 (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. **06**

- (b)** Explain Ant colony optimization with example. **06**

OR

- (b)** Explain the concept and algorithm of Cellular Automata technique with example. **06**

- Q.3 (a)** List the first four search directions for Powell's method to minimize $(x) = x_1^2 + \exp(x_1^2 + x_2^2)$, starting at the point (2, 2). **06**

- (b)** Minimize Rosenbrock function $f(x) = 100(x_2 - x_1^2)^2 + (1 - x_1^2)$ with an initial point of (-1.2, 1.0) using fletcher- method up to two iterations. **06**

OR

- Q.3 (a)** For minimization of objective function $y = 3x_1^2 + 2x_1x_2 + x_2^2$, search for the minimum starting from base point (5,5). Use a set of conjugate directions for search. **06**

- (b)** Explain concept of region elimination methods and compare performance of different region elimination methods. **06**

- Q.4 (a)** Find the maximum of $y = 10x_1^2 - 4x_1x_2 + 3x_2^2 + 5x_2x_3$ subject to $x_1 + 2x_2 \leq 3$; $x_2 - x_3 \geq 2$; $x_1 \geq 1$ using lagrangian multipliers. **06**

- (b) List out the techniques/methods which can be used to solve the optimization problem: Find the minimum of $y = 4x_1^2 + 5x_2^2$ subject to $2x_1 + 3x_2 = 6$. Solve it using any method of your choice. **06**

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. **06**

- (b) An open top box is to be made out of a piece of cardboard measuring 2m X 2m by cutting off equal surfaces from the corners and turning up the side. Find height of the box for maximum volume. **06**

- Q.5 (a)** Explain Bee colony optimization with algorithm. **06**

- (b) Explain the concept and algorithm of Simulated Annealing technique with example. **06**

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. **12**

		<i>Available alloys</i>				
		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
