Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject Code: 2721602 **Date: 08/12/2015**

Subject Name: Chemical Process Optimization

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)** Using the Rosenbrock search technique, seek the minimum of the objective function $y = x_1^2 + 3x_2^2 + 5x_3^2$ using $s_1 = s_2 = s_3 = 1$, $\beta = 1/2$ and $\alpha = 3$. Carry out one stage of search and find directions for next iteration. **08**

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

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. **07**

(b) Explain the concept and algorithm of Differential Evolution technique with example. **07**

OR

(b) Explain the concept and working of Genetic Algorithm **07**

Q.3 **(a)** List the first four search directions for Powellôs method to minimize $(x) = x_1^{\ 2} + \exp(x_1^{\ 2} + x_2^{\ 2})$, staring at the point (2, 2). **07**

(b) Carryout eight cycle of vertex rejection and regeneration in searching for the minimum of the objective function $y = x_1^{\ 2} + 3x_2^{\ 2} + 5x_3^{\ 2}$ using the Sequential Simplex method. Distance between vertices is a = 0.5 and one of the vertex at the point {0,0,0}. **07**

OR

Q.3 **(a)** Define a suitable search region and a feasible initial base point for the complex method of search in minimizing $y = 5x_1^{\ 3} - 3x_1^{\ 2}x_2 + x_2^{\ 2}$ subject to the restrictions that **07**

$$3 + 2x_1 - 3x_2 \le 0$$

$$(x_1 - 1)^2 + (x_2 - 2)^2 \le 4$$

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

(b) Carry out two stages of a Hooke-Jeeves search for searching a minimum of the objective function $y = x_1^2 + 3x_2^2 + 5x_3^2$. Use δ = 0.5, starting from the base point (2, -1, 1). A stage consists of a local exploration, together with an accelerated move. **07**

Q.4 **(a)** 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. **07**

(b) Explain the interpretations with examples for **07**

- No positive ratio.
- Identical values of smallest positive ratio.

while solving any linear programming problem using simplex method.

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) A log has the form of a frustum of cone 30 feet long, the diameters of its ends being 2 feet and 1 foot. A beam of square section is to be cut from the log. Find the length if the volume is maximum. **07**

Q.5 **(a)** Explain the basics of Multi objective optimization (MOO). Classify the methods for MOO and discuss chemical engineering applications. **07**

(b) Explain the concept and algorithm of Simulated Annealing technique with example. **07**

OR

Q.5 Find the minimum of the function $y = 3x_1 + 5x_2$ **14**

Subject to the restrictions

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

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

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