Unit III

5. A, diet conscious housewife wishes to ensure certain minimum intake to vitamins A, B and C for a family. The minimum daily needs of the vitamins A, B, C for the family are respectively 30, 20 and 16 Units. For the supply of these minimum vitamin requirements, the housewife relies on two fresh foods. The first one provides 7, 5, 2 units of the three vitamins per gram respectively and the second one provides 2, 4, 8 Units of the same three vitamins per gram of the foodstuff respectively. The first food stuff costs Rs. 3 per gram and the second Rs. 2 per gram. The problem is how many grams of each food stuff should the housewife by everyday to keep her food bill as low as possible ?

(a) Formulate the problem as LPP.

(b) Write the dual problem, solve it by using simplex method.

(c) Interpret the dual problem and its solution. **15**

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CC-181

M. Tech. EXAMINATION, Dec. 2017

(Third Semester)

(Main & Re-appear)

(CHE)

CHE-601-B

OPTIMIZATION OF CHEMICAL PROCESSES

Time : 3 Hours] [*Maximum Marks : 75*

Before answering the question-paper candidates should ensure that they have been supplied to correct and complete question-paper. No complaint, in this regard, will be entertained after the examination.

Note : Attempt *Five* questions in all, selecting at least *one* question from each Unit. All questions carry equal marks.

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Unit I

1. (a) Discuss the local maximum or minimum point (if any) of the function :

$$f(x_1, x_2, x_3) = x_1x_2 + 10x_1 - x_1^2 + x_2^2 - x_3^2$$

10

(b) State the necessary and sufficient conditions for unconstrained minimum of functions. **5**

2. (a) Discuss Newton and quasi-Newton method. **5**

(b) Find the minimum of the function :

$$f(x) = 0.65 - \frac{0.75}{1+x^2} - 0.65x\tan^{-1}\left(\frac{1}{x}\right)$$

Using quasi-Newton method with the starting point $x_1 = 0.1$ and the step size $\Delta x = 0.01$ in central difference formulas. Take $\in = 0.01$ for checking the convergence. **10**

Unit II

3. (a) Write a note on Random search and grid search. **5**

(b) Minimize

$$f(x_1, x_2) = 4x_1^2 + 3x_2^2 - 5x_1x_2 - 8x_1$$

starting from point (0, 0) using Powell's method. Perform four interations. **10**

4. (a) Solve the following system of equations using Newton's method of unconstrained minimization with the starting point. **10**

$$X_1 = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$$

$$2x_1 - x_2 + x_3 = -1$$
$$x_1 + 2x_2 = 0$$
$$3x_1 + x_2 + 2x_3 = 3$$

(b) Enumerate on conjugate search method. **5**

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(b) Write a note on novel techniques for optimization of non-linear programming problem with constraints. **7**

8. Write notes on the following : **15**

(a) General Reduced gradient

(b) Successive quadratic programming.

6. (a) Use graphical method to :

Maximize $Z = 4x_1 + 3x_2$

Subject to the constraints

$$3x_1 + 4x_2 \leq 24$$
$$4x_1 + 3x_2 \leq 24$$
$$x_1 \leq 5$$
$$x_2 \leq 6$$
$$x_1, x_2 \geq 0$$

7

(b) Use simplex method to

Maximize $Z = 50x_1 + 75x_2$

Subject to the constraints

$$3x_1 + 4x_2 \leq 4000$$
$$8x_1 + 9x_2 \leq 7000$$
$$x_1 + x_2 \leq 1500$$
$$x_1 \geq 150$$
$$x_2 \geq 90$$

8

Unit IV

7. (a) Discuss necessary and sufficient conditions for local extremum for non-linear programming. **8**

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