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ECH021

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 151654

Roll No.

B. Tech.

(SEM. VI) THEORY EXAMINATION, 2014-15

OPTIMIZATION TECHNIQUE IN CHEMICAL ENGINEERING

Time : **2** Hours] [Total Marks : **50**

Note : (1) Attempt All questions.
(2) Assume suitable data, if required.

1 Attempt any four parts of the following. **3x4=12**

(a) Find the volume of the largest rectangular solid inscribed in the ellipsoid.

$$\left\{x^2/a^2\right\}+\left\{y^2/b^2\right\}+\left\{z^2/c^2\right\}=1$$

(b) Find the maximum and minimum values of the function.

$$f(x)=12x^5-45x^4+40x^3+5$$

(c) Find the maximum and minimum values of the function.

$$f(x,y)=x^3+y^3-3x-12y+25$$

(d) Enumerate the Scope and limitations of optimization techniques.

(e) Write short note on "Feasible solution and feasible region'.

(f) Discuss about constrained optimization problems.

2 Attempt any two parts of the following. **7x2=14**

(a) Define a linear programming problem. Solve the following linear programming problem (LPP) by graphical method.

Maximize $5x + 3y$

Subject to

$$4x + 5y \leq 10$$
$$5x + 2y \leq 10$$
$$3x + 8y \leq 12$$
$$\text{and } x \geq 0,\ y \geq 0$$

(b) Solve the following LPP graphically.

Min $z = 2x_1 + x_2$

Subject to $3x_1 + x_2 \geq 3$

$$4x_1 + 3x_2 \geq 6$$
$$x_1 + 2x_2 \geq 2$$
$$\text{and } x_1,\ x_2 \geq 0$$

(c) Find the maximum of $f = x\,(1.5 - x)$ in the interval (0,0,1.00) within 10% of exact value.

3 Attempt any two parts of the following : **6×2=12**

(a) Define a transportation problem. Prove that every transportation problem has a feasible solution.

(b) Obtain a basic feasible solution of the following transportation problem.

3	5	6	4	1700
6	8	2	3	1900
5	7	4	11	1000
8	5	13	10	1400
1000	1200	1500	2300	

(c) Describe Fibonacci search method for a unimodel function of a single variable.

4 Attempt any two parts of the following. **6x2=12**

(a) Discuss the scope and hierarchy of optimization.

(b) State Newton-Raphson method for finding the points of maximum/minimum of an universal function. Hence find the point of minimum of the function.

$$f(x) = x^2 + 54/x$$

(c) Find the dimensions of cylindrical tin (with top and bottom) made up of sheet metal to maximize its volume such that the total surface area is equal to $A_0 = 24\pi$.