# B. Tech.

## (SEM. VI) THEORY EXAMINATION 2011-12

## OPTIMIZATION TECHNIQUE IN CHEMICAL ENGINEERING

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

**Note :—** (i)  Attempt *all* questions.

(ii)  Assume suitable data, if missing.

1.  Attempt any **four** parts of the following questions :—

(3×4=12)

(a)  State the necessary and sufficient conditions for the minimum of a function f(x).

(b)  Define the saddle point and indicate its significance.

(c)  What is the significance of Lagrange multipliers ?

(d)  What do you mean by convex function and concave function ?

(e)  Differentiate between constrained and unconstrained problem with suitable examples.

(f)  Find the maxima and minima, if any, of the function

$$f(x) = 4x^3 - 18x^2 + 27x - 7.$$

2.  Attempt any **two** parts of the following questions :—

(6×2=12)

(a)  Find the minimum of the function

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

using Quasi-Newton method with the starting point $\lambda_1 = 0.1$ and step size $\Delta\lambda = 0.01$ in the central difference formulas. Use $\varepsilon = 0.01$ for checking the convergence.

(b) Explain the secant method of uni-dimensional search.

(c) Minimize $f(x) = 0.65 - \dfrac{0.75}{1+x^2} - 0.65x \tan^{-1}\dfrac{1}{x}$ in the inteval [0, 3] by the Fibonacci method using $n = 6$.

3. Attempt any two parts of the following questions :—

$$(6\frac{1}{2}\times2=13)$$

(a) What are the various direct and indirect methods of multi-variable search ? Discuss any one in detail.

(b) Solve the following LPP by using graphical method :

Minimize : $f = 3x_1 + 2x_2$

Subject to $8x_1 + x_2 \geq 8$

$2x_1 + x_2 \geq 6$

$x_1 + 3x_2 \geq 6$

$x_1 + 6x_2 \geq 8$

$x_1 \geq 0, x_2 \geq 0$

(c) Solve the following LPP by using simplex method :

Maximize : $Z = 3x_1 + 5x_2 + 4x_3$,

Subject to $2x_1 + 3x_2 \leq 8$

$3x_1 + 2x_2 + 4x_3 \leq 15$

$2x_2 + 5x_3 \leq 10$

and $x_1 \geq 0, x_2 \geq 0, x_3 \geq 0$.

4. Attempt any two parts of the following questions :—

$$(6½×2=13)$$

(a) A small machine tool manufacturing company entered into a contract to supply 80 drilling machines at the end of first month and 120 at the end of second month. The unit cost of manufacturing a drilling machine in any month is given by $ $(50x + 0.2x^2)$, where x denotes the number of drilling machines manufactured in that month. If the company manufactures more unit than needed in the first month, there is an inventory carrying cost of $8 for each unit carries to the next month. Find the number of drilling machines to be manufactured in each month to minimize the total cost. Assume that the company has enough facilities to manufacture upto 200 drilling machines per month and that there is no initial inventory. Solve the problem as final value problem. https://www.aktuonline.com

(b) Find the maximum of $f = x (1.5 - x)$ in the interval (0.0, 1.0) within 10% of the exact value.

(c) What is the principle of Optimality ? Discuss about optimal solution and optimal basic solution.