Printed Pages: **ECH-021**

(Following Paper ID and Roll No. to be filled in your Answer Books)	
Paper ID : 151654	**Roll No.**

B.TECH.

Theory Examination (Semester-VI) 2015-16

OPTIMIZATION TECHNIQUE IN CHEMICAL ENGINEERING

Time : 3 Hours ***Max. Marks : 100***

Note : (1) Attempt all questions.
(2) Assume suitable data if missing.

Section-A

1. Attempt each short answer type questions. (10×2=20)

(a) Discuss the scope and hierarchy of optimization.

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

(c) What do you mean by convex function concave function?

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

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

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

(f) Explain the concept of duality in linear programming.

(g) Describe the general procedure for solving the optimization problem.

(h) Enumerate few engineering applications of optimization.

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

(j) Define slack and artificial variables.

Section-B

2. Attempt any five parts of the following. (10×5=50)

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

(b) The total annual cost of a pump and motor (C) in a particular piece of equipment is a function of size of the motor (X) in horsepower,as

$$C = 500 + 0.9\ X + 0.3\ (150000)/X \quad \text{in \$}$$

Find the motor size that minimizes the total annual cost.

(c) Find the minimum of the function

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

Using Newton-Raphson method with the starting point $x_1 = 0.1$. Use $= 0.01$ for checking the convergence.

(d) Solve the following LPP graphically,

Minimise $f = 3x_1 + x_2$

Subject to $8x_1 + x_2 \geq 8$

$2x_1 + x_2 \geq 6$

$x_1 + 3x_2 \geq 6$

$x_1 + 6x_2 \geq 8$

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

(e) Solve the following LPP by simplex method,

Maximize $f = x_1 + 3x_2$

Subject to $- x_1 + x_2 \leq 1$

$x_1 + x_2 \leq 2$

(f) Describe the Newton's method to find an optimality of a function of one variable.

(g) Find the minimum of the function

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

in the interval [0,3] by the Fibonacci method using n=6.

(h) Find the minimum of f(x) = x(x-1.5) in the interval (0,1) within 10% of the exact value and δ = 0.001

Section-C

Note: Attempt any two parts of the following. (15×2=30)

3. What are the various direct and indirect methods of multivariable search? Discuss any one of them.

4. (i) Advantages of dynamic programming.

(ii) Principle of optimality.

5. (i) Describe the gradient method for determining the search direction of first order systems.

(ii) Define transportation problem prove that every transportation problem as a feasible solution.