(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. $(10\times2=20)$
 - (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: $(10 \times 5=50)$
 - (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

$$C = 500 + 0.9 X + 0.3 (150000)/X$$
 in \$

Find the motor size that minimizes the total annual cost.

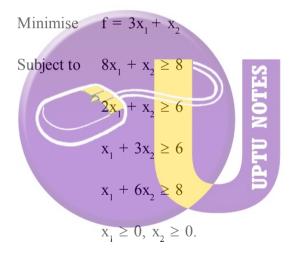
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(c) Find the minimum of the function

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

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,



(e) Solve the following LPP by simplex method,

Maximize
$$f = x_1 + 3x_2$$

Subject to $-x_1 + x_2 \le 1$
 $x_1 + x_2 \le 2$

1 (3) P.T.O. WWW.UPTUNOTES.COM

- (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 $\delta = 0.001$

Section-C

Note: Attempt any two parts of the following.

 $(15 \times 2 = 30)$

- 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.

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