Exam. Code: 1017
Sub. Code: 7781

1079

M.E. Electrical Engineering (Power Systems)

1st Semester

EE-8103: Optimization Techniques

Time allowed: 3 Hours | Max. Marks: 50

NOTE: *Attempt any five questions. Use of simple calculator is allowed. Each question carries equal marks.*

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I. Consider the LPP;

Maximize $Z = 3x_1 + 5x_2$,

Subject to $x_1 \le 4, 3x_1 + 2x_2 \le 18, x_1, x_2 \ge 0$.

If a new variable x_5 in introduced with $C_5=7$ and $a_5 = [1,2]$, discuss the effect of new variable and obtain the revised solution, if any.

II. Consider the data in the following table. Assume that all the three retailers know that the total supply is 250 and total demand is 230. Retailer 2 is willing to take upto an additional 20 units while retailer 3 is willing to take up an additional 10 units. How much each retailer gets?

Transportation costs			
4	3	5	100
5	7	8	150
80	60	9	

III. (a) Prove or disprove concavity of the function: $f(x_1,x_2) = 10 - 2(x_2 - x_1^2)^2$ defined over the set $S = \{(x_1,x_2) | -1 \le x_1 \le 1, -1 \le x_2 \le 1\}$.

(b) Consider the problem: $Min. f(x) = (x_1 - 2)^2 + (x_2 - 5)^2$, subjected to the constraints: $-x_1 + x_2 \le 2,\ 2x_1 + 3x_2 \le 11,\ x_1, x_2 \ge 0$. Is $(0,0)^T$ is an optimal solution of the problem? If not, find the optimal solution.

IV. Use Wolfe's method to solve the quadratic programming problem:

Maximize $Z = 2x_1 + 3x_2 - 2x_1^2$

Subject to $x_1 + 4x_2 \le 4,\quad x_1 + x_2 \le 2;\quad x_1, x_2 \ge 0$

V. (a) Solve the following nonlinear programming problem by Lagrange's multiplier method:

Maximize $f(x) = 4x_1^2 + 2x_2^2 + x_3^2 - 4x_1x_2$

Subject to: $x_1 + x_2 + x_3 + 15,\quad 2x_1 - x_2 + 2x_3 = 20,\quad x_1, x_2, x_3 \ge 0$

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(b) Write the dual of the following nonlinear programming problem:
Minimize $f(x) = -4x_1 - 2x_2 + x_1^2 + x_2^2$
Subject to: $2x_1 - x_2 \le 7, \quad -x_1 + x_2 \le -2, \quad x_1, x_2 \ge 0$

VI. (a) Using steepest method, find the minimum of the function: $f(x) = x_1^2 - x_1x_2 + x_2^2$, so that error does not exceed by 0.05. The initial approximation is to be taken as $\left(1, \frac{1}{2}\right)$.

(b) Why a conjugate direction method is preferred in solving a general nonlinear problem?

(c) What are reasons for possible divergence of Newton's method?

VII. (a) Let $S \subseteq R^n$ be a non empty convex set and $f : S \to R$ be a mapping. Prove that:

(i) If f is convex on S, then f is quasi-convex on S.

(ii) If f is concave on S, then f is Quasi-Concave on S.

(b) Prove that the function $f(x) = x_1x_2$ in quasi-concave on $S = \{(x_1, x_2) \mid x_1 > 0, x_2 > 0\}$. Also check the convenity or concavity.

VIII. Solve $z(s) = \dfrac{-2x_1 + x_2 + 2}{x_1 + 3x_2 + 4}$, subject to constraints: $-x_1 + x_2 \le 4, \quad 2x_1 + x_2 \le 14 \quad x_2 \le 6, \quad x_1, x_2 \ge 0.$

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