Exam. Code: 1017
Sub. Code: 7781

1129

M.E. Electrical Engineering (Power Systems)

1st Semester

EE-8103: Optimization Techniques

Time allowed: 3 Hours

Max. Marks: 50

NOTE: *Attempt **five** questions in all. Use of simple calculator is allowed.*

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I. Given the linear programming problem:
Maximize $z = 3x_1 + 5x_2$
Subject to the constraints: $x_1 \le 4, x_2 \le 6, 3x_1 + 2x_2 \le 18,$
$x_1, x_2 \ge 0$
Discuss the effect on the optimality solution when the objective function is changed to $3x_1 + 2x_2$. (10)

II. Consider the problem of transporting TV sets of a particular brand (TVX) from 2 warehouses to 3 retail shops. The demand in the three retailers in 80, 60 and 90 while 100 and 120 sets are available in the two warehouses. The cost of transportation is defined as a unit cost of transportation on item from a warehouse to retailer and these are given in the following table: Supply, demand and costs.

4	6	5	100
5	7	8	150
80	60	90	

Find the optimal solution with least total cost of transportation. (10)

III. (a) What is convex programming problem and what is its signifiance?

(b) Consider the problem:

Minimize $f(x) = x_1^2 + x_2^2 + 2x_2$

Subject to $2x_1 + 3x_2 \ge 1, \quad x_1^2 + x_2^2 \le 1$
$x_1, x_2 \ge 0$

(i) Are the point $\left(\frac{1}{2}, 0\right)^T$ *and* $\left(\frac{1}{2}, \frac{\sqrt{3}}{2}\right)$ are local optimal solution of the problem? Give reasons for your answer.

(ii) Test if any one of these two solutions is an optimal solution. (10)

P.T.O.

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

Maximize $z = x_1 + 2x_2 - x_2^2$

Subject to $x_1 + 2x_2 \le 4,\quad 3x_1 + 2x_2 \le 6$

$x_1, x_2 \ge 0$ (10)

V. (a) Solve the following nonlinear programming problem using K-T conditions:

Maximize $f(x) = 4x_1 + 6x_2 - 2x_1^2 - 2x_1x_2 - 2x_2^2 + 49$

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

(b) Write the dual of the following nonlinear programming problem:

Minimize $f(x) = x_1^2 + x_2^2$

Subject to $x_1^2 + x_2^2 \le 5,\quad x_1 + 2x_2 = 4,\quad x_1, x_2 \ge 0$ (10)

VI. (a) Use the steepest descent method to establish the next search direction to determine approximate minimum point of the function: $f(x,y) = x^2 + y^2 + xy\sin(xy)$, from the point $x = \frac{\pi}{3}, y = 1$.

(b) Prove that Newton's method finds the minimum of a quadratic function in one iteration. Why is a quadratic convergent method considered to be superior for the minimization of a non-linear function? (10)

VII. (a) Write a note on generalized convex functions and their applications to nonlinear optimization problem.

(b) Over what subset of R^2, the following funciton: $f(x_1, x_2) = x_2 e^{-x_1}$, is quasi convex and quasi-concave? (10)

VIII. Minimize $z = \dfrac{-x_1 + 2x_2}{5x_1 + 3x_2 + 2}$,

Subjct to constraints: $3x_1 + 6x_2 \le 8,\quad 5x_1 + 2x_2 \le 10,\quad x_1, x_2 \ge 0$ (10)

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