Hall Ticket No: | | | | | | | | | | | **Question Paper Code :**

ANIL NEERUKONDA INSTITUTE OF TECHNOLOGY & SCIENCES
(AUTONOMOUS)

M.E/M.Tech I-Semester Regular Examinations, November 2015

Engineering Optimization
(Control Systems Engineering)

Date: **Time: 3 hours** **Max Marks: 60**

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

1 a) State an optimization problem. Give any five engineering applications of optimization. (5 M)

b) A firm manufactures two types of products A and B, And sells them at a profit of Rs.2 on type A and Rs.3 on type B. Each product is processed on two machines G and H. Type A requires one minute of processing time on G and two minutes on H; Type B requires one minute on G and one minute on H. The machine G is available for not more than 6 hours and 40 minutes. While machine H is available for 10 hours during any working day. Formulate the L.P.P so as to maximize the profit. (7 M)

(or)

2 a) What is the difference between linear and nonlinear programming problems? (5 M)

b) Food X contains 6 units of vitamin A per gram and 7 units of vitamin B per gram and costs 12 paisa per gram. Food Y contains 8 units of vitamin A per gram and 12 units of vitamin B and costs 20 paisa per gram. The daily minimum requirements of vitamin A and vitamin B are 100 units and 120 units respectively. Formulate the L.P.P so as to minimize the cost of product mix. (7 M)

3 a) State necessary and sufficient conditions for the minimum of a single variable function. (6 M)

b) Find the extremes of the function $f = -X_1^2 + 4X_1X_2 - 9X_2^2 + 2X_1X_2 + 8X_2X_3 - 4X_3^2$ (6 M)

(or)

4 a) State the Kuhn-Tucker conditions. (5 M)

b) Minimize $f = \frac{1}{2}(X_1^2 + X_2^2 + X_3^2)$ (7 M)
Subjected to: $X_1 - X_2 = 0$
$X_1 + X_2 + X_3 - 1 = 0$
Using Constrained Variation Method

5 a) Obtain the duality of the following LPP (6 M)

Minimize $Z= -5X_1+2X_2 + 10X_3$

Subjected to: $2X_1 - X_2 +5X_3 \geq 25$

$X_1 – X_3 = 12$

$X_1 +X_2 \leq 10$ and $X_1, X_3 \geq 0$, X_2 unrestricted in sign

b) Solve the following L.P.P using Revised Simplex Method (6 M)

Maximize $Z = 4X_1+ 3X_2$

Subjected to: $2X_1 + 3X_2 \leq 6$

$-3X_1 +2X_2 \leq 3$

$2X_2 \leq 5$

$2X_1 +X_2 \leq 4$ and $X_1, X_2 \geq 0$

(or)

6 Solve the following LPP using Two-Phase Method (12M)

Minimize $Z = 4X_1+ X_2$

Subjected to: $3X_1 + X_2 = 3$

$4X_1 +3X_2 \geq 6$

$X_1 +2X_2 \leq 3$ and $X_1, X_2 \geq 0$

Solve the following LPP using Two-Phase Method

7 a) Explain the Powell's method with flow chart. (6 M)

b) Minimize $f = X_1^2 + 3X_2^2 + 6X_3^2$ by Hooke-Jeeves method by taking $\Delta x_1 = \Delta x_2 = \Delta x_3 = 0.5$ and the starting points as (2, -1, 1). Perform two iterations. (6 M)

(or)

8 Minimize $f = X_1 – X_2 + 2X_1^2 + 2X_1X_2 + X_2^2$ from the starting point (0,0) using Marquardt method with $\alpha_1 = 10^4$, $C_1 = 0.25$, $C_2 = 2$, and $\varepsilon = 0.01$. Perform three iterations. (12M)

9 a) How is the direction – finding problem solved in Zoutendijk's method? (6 M)

b) Minimize $f(X)= X_1^2 +X_2^2 – 6X_1 – 8X_2 + 10$ (6 M)

Subjected to: $4X_1^2 + X_2^2 \leq 16$

$3X_1 + 5X_2 \leq 15$

$X_i \geq 0$, i=1,2

With the starting point $X_1 =(1,1)$. Using cutting plane method. Complete one step of the process.

(or)

10 Minimize $f(X) = 9X_1^2 +6X_2^2 +X_3^2– 18X_1 – 12X_2 – 6X_3 - 10$ (12M)

Subjected to: $X_1 + 2X_2 +X_3 \leq 4$

$X_i \geq 0$, i=1,2,3

Using the starting point $X_1 = (0,0,0)^T$, complete one step of sequential linear programming method.