[Time: Three Hours] [Marks:80]

Please check whether you have got the right question paper.

N.B: 1. Attempt any Four Question
2. Make suitable assumptions if required

Q.No.1 **(a)** Solve using Gromory Method **(10)**

Maximize $Z = 3x_1 + x_2$

subject to $2x_1 - x_2 \leq 6$

$3x_1 + 9x_2 \leq 45$

$x_1, x_2 \geq 0$

x_1, x_2 *are integers*.

(b) Find the value of x where the unimodal function is **(10)**

f(x) = x^2 - 2.6x + 2,

-2 ≤ x ≤ 3. Take δ = 0.01, l = 0.2 by Fibonacci Method

Q.No.2 **(a)** Write a short note on Sensitivity Analysis **(05)**

(b) Get primal from following dual, **(05)**

Maximize $Z = 4y_1 + 2y_2 + 4y_3$

Subjected to, $-2y_1 + 3y_2 + y_3 \leq -2$

$5y_1 + 6y_2 + y_3 = -1$

$-3y_1 - y_2 + y_3 \leq 1$

$y_1, y_2 \geq 0, y_3$ Unrestricted in sign

(c) Solve using Simplex method **(10)**

Minimize $Z = -4x_1 - 5x_2$

Subjected to, $-x_1 + x_2 + x_3 = 4$

$x_1 + x_2 + x_4 = 6$

$x_i \geq 0, i = 1$ to 4

Q.No.3 **(a)** Use Newton's method and perform 4 iteration to minimize, **(10)**

$f(x) = 0.5 - x \exp(-x^2)$

(b) Using Quadratic Interpolation method, **(10)**

Minimize, $f(\alpha) = 2 - 4\alpha + e^\alpha$

Q.No.4 **(a)** A manufacturing firm producing small refrigerators has entered into a contract to supply **(15)** 50 refrigerators at the end of the first month, 50 at the end of the second month, and 50 at the end of the third. The cost of producing x refrigerators in any month is given by $\$(x^2 + 1000)$. The firm can produce more refrigerators in any month and carry them to a subsequent month. However, it costs $20 per unit for any refrigerator carried over from one month to the next. Assuming that there is no initial inventory, determine the number of refrigerators to be produced in each month to minimize the total cost.

(b) Write the steps in formulating optimization problem for following problem. **(05)**

The goal of this project is to choose insulation thickness t to minimize the life-cycle cooling cost for a spherical tank. The cooling costs include the cost of installing and running the refrigeration equipment, and the cost of installing the insulation. Assume a 10-year life, 10 percent annual interest rate, and no salvage value. The tank has already been designed having r (m) as its radius.

Q.No.5 **(a)** Write a short note on (i) 2^k Factorial Design (ii) Central Composite Design **(10)**

(b) Find the maximum of the function $f(x) = 2x_1 + x_2 + 10$ **(10)**

subject to $g(x) = x_1 + 2x_2^2 = 3$

Using the Lagrange multiplier method. Also find the effect of changing the right-hand side of the constraint on the optimum value of f.

Q.No.6 **(a)** Write a short note on (i) Generation of random variable and (ii) Monte-Carlo Technique **(10)**

(b) Using the Duel Simplex method, find the optimum solution. **(10)**

Minimize $f = 3x_1 + 5x_2 + 2x_3$

Subjected to, $-x_1 + 2x_2 + 2x_3 \leq 3$,

$x_1 + 2x_2 + x_3 \geq 2$

$2x_1 + x_2 - 2x_3 \leq 4$

$x_i \geq 0, i = 1$ to 3