ME 209 NUMERICAL METHODS

PROBLEM HOUR II

QUESTION 1

Question 1. To find the square root of a number a, one can use the following equation:

f(c)=c^2-a=0

where C is the square root of a.

Use the **Bisection method** to determine the square root of **5** with an absolute approximate relative percentage error ε_a below **1%**.

Use initial guesses of c_l=2 c_u=3

QUESTION 2

Use the **Newton–Raphson method** to determine the square root of **5** using the same equation given in Question 1.

$$f(c)=c^2-a=0$$

Perform iterations until the absolute approximate relative percentage error ε_a falls below **0.005%**.

Use an initial guess of $c_0=2$.

QUESTION 3

By applying the force equilibrium equations to each block along the inclined plane, the following system of simultaneous linear algebraic equations is obtained:

$12x_1$-$2x_2$=44

-$2x_1$+$10x_2$-$3x_3$=9

-$3x_2$+$9x_3$=33

where x_1, $x_2$and x_3.represent the equilibrium displacements of the three blocks (in mm).

Use the **Jacobi iterative method** to determine the displacements x_1, $x_2$and x_3.

Use the initial guesses:

$x_1^{(0)}$=$x_2^{(0)}$=$x_3^{(0)}$=0

Perform iterations until the absolute approximate relative percentage error ε_a for all unknowns falls below **5%**.

QUESTION 4

Use the **Gauss–Seidel method** to solve the following system of simultaneous linear algebraic equations:

$3x_1$+-$7x_2$+-x_3=19

-$9x_1$+x_2-$2x_3$==-37

-$2x_1$-x_2+$8x_3$=28

Use initial guesses of:

$$x_1 = 0$$
$$x_2 = 0$$
$$x_3 = 0$$

Perform iterations until the absolute approximate relative percentage error for all unknowns falls below **5%**.If necessary, rearrange the equations to ensure convergence.Three blocks are placed on a frictionless inclined plane and connected by linear springs. The first and third blocks are also connected to fixed supports by springs.