



Central Mindanao University  
College of Engineering  
Civil Engineering Department  
CE-33 Numerical Solutions to CE Problems

Long Quiz No.2  
April 8, 2021

**Instructions:** Using A-4 or 8.5" x 11" size paper, solve the following neatly. Show all necessary solutions and assumptions clearly. Submit a scanned copy or a photo of your work in the Google classroom on or before the specified time.

1. Determine the approximate solution of the system of linear equations below using **Gauss- Seidel Iteration** after 8 iterations. Show all iterations/solutions. Provide a brief discussion of your solution.

$$\begin{cases} 5x_1 + x_2 + x_3 - x_4 + 2x_5 = 0.2B + 7 \\ x_1 - 6x_2 + x_3 + x_4 - 2x_5 = 0.1C - 4.5 \\ 2x_1 + x_2 - x_3 - 8x_4 + 2x_5 = 0.15D - 3.5 \\ 2x_1 + x_2 + 2x_3 - 2x_4 + 7x_5 = 0.3A + 3 \\ -x_1 + 2x_2 + 6x_3 - x_4 - x_5 = 14 - 0.1C \end{cases}$$

Assume:  $\begin{bmatrix} x_1^{(0)} \\ x_2^{(0)} \\ x_3^{(0)} \\ x_4^{(0)} \\ x_5^{(0)} \end{bmatrix} = \begin{bmatrix} 1 \\ 0 \\ 1 \\ 0 \\ 1 \end{bmatrix}$

2. A simply supported I-beam is loaded with a distributed load, as shown. The deflection,  $y$ , of the center line of the beam as a function of the position,  $x$ , is given by the equation:

$$y = \frac{w_0 x}{360EI} (7L^3 - 10L^2x^2 + 3x^4)$$

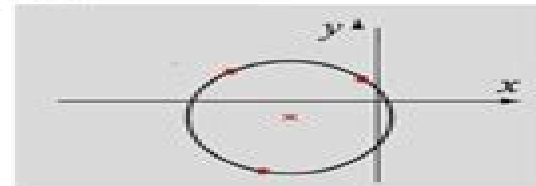


Where  $L = (4.2 + 0.3C)$  m is the length,  $E = (70 + 0.5D)$  GPa is the elastic modulus,  $I = (52.9 + A) \times 10^{-6}$  m<sup>4</sup> is the moment of inertia, and  $w_0 = (18.5 + 0.5B)$  kN/m. Find the position  $x$  where the deflection of the beam is maximum, and determine the deflection at this point.

Hint: The maximum deflection is at the point where  $dy/dx = 0$ . Use **Newton - Raphson Method** with tolerance of 0.001. Provide a brief discussion of your solution.

3. In a Cartesian coordinate system the general equation of a circle is:

$$x^2 + y^2 + Dx + Ey + F = 0$$



Given three points,  $\{(-1 + 0.1C), (3 + 0.5B)\}$ ,  $\{(-7.5 + 0.1D), (4 - 0.2B)\}$ , and  $\{(-5.5 + 0.2C), (-9.2 + 0.4A)\}$ . Determine the equation of the circle that passes through the points.

Solve the problem by deriving a system of three linear equations and solve the system using **Jacobi Iteration** up to 7 iterations and assume all initial values equal to 0.5. Provide a brief discussion of your solution.

# Numerical Solution Of Field Problems In

**CL Gary**



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