Birzeit University
Department of Civil Engineering
Structural Analysis II ENCE3341
Final Exam
1st Semester 2020/2021

Question 1 (60 points)

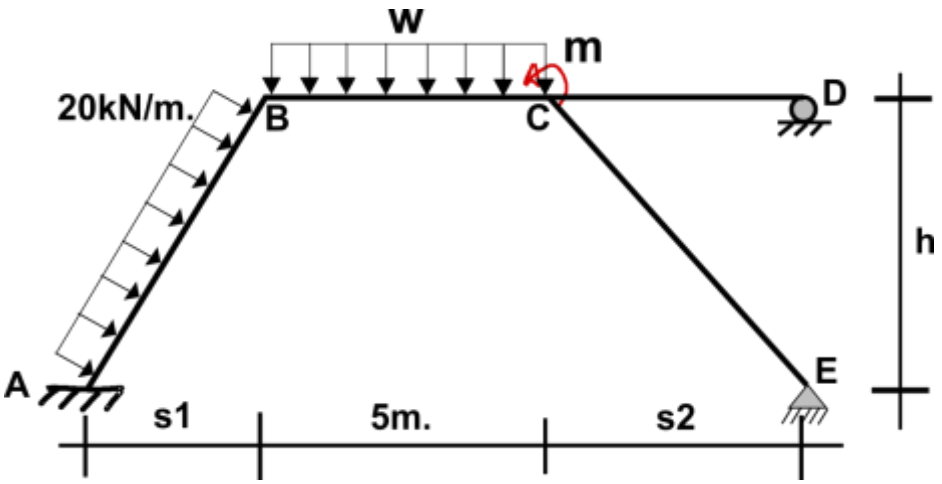
The frame system has fixed supports at A, pin support at E, roller support at D. The system supports distributed loads on elements AB and BC and a concentrated moment at C. Use **moment distribution method** to analyze the system

a. Assume **different values** for h, s1, s2, w, and m

b. Find the end-moments of the frame elements

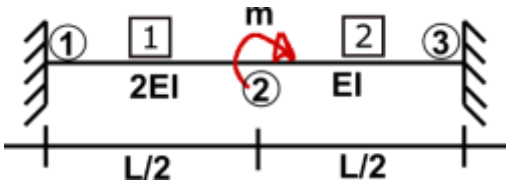
c. Draw shear and bending moment diagrams for the frame indicating key values

d. Draw the deformed shape of the frame system



Question 2 (40 points)

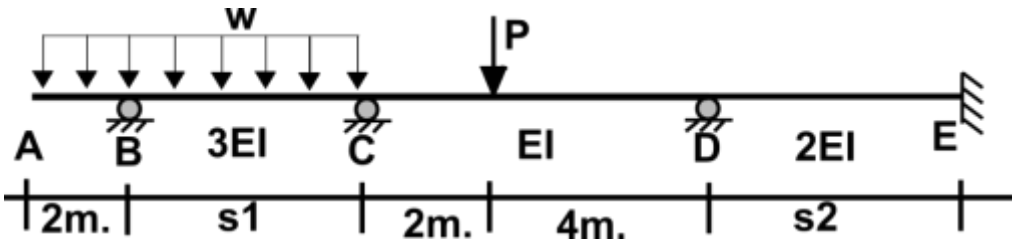
For the beam system shown below find the end-moments in terms of m and L using **direct stiffness method.** Use the provided nodes and elements numbers as shown in the figure

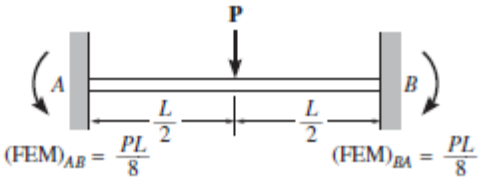


Question 3 (50 points)

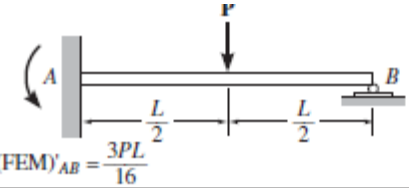
The beam system shown below is supported by roller supports at B, C, and D and fixed support at E. The beam supports the loading shown below and supports C and D settles downwards 6mm and 2mm respectively. Knowing that E=30GPa and I=1200x10^6mm^4, use **<u>slope-deflection equations to analyze the system</u>**

a. Assume **different values** for s1, s2, w and P
b. Find the reaction forces of the system
c. Find the end moments of the beam elements
d. Draw shear and bending moment diagram indicating key values
e. Explain the similarity between slope-deflection equations method and direct stiffness method

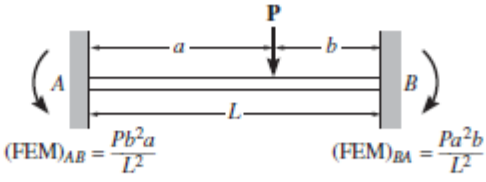




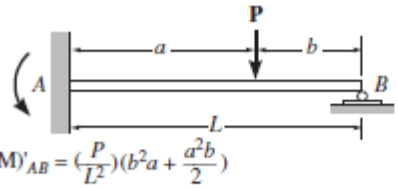
$(FEM)_{AB} = \frac{PL}{8}$ $(FEM)_{BA} = \frac{PL}{8}$



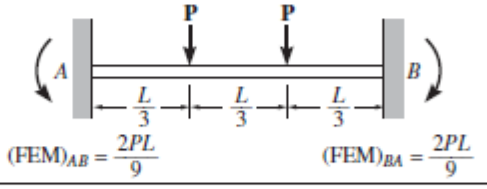
$(FEM)'_{AB} = \frac{3PL}{16}$



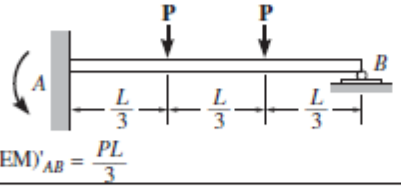
$(FEM)_{AB} = \frac{Pb^2a}{L^2}$ $(FEM)_{BA} = \frac{Pa^2b}{L^2}$



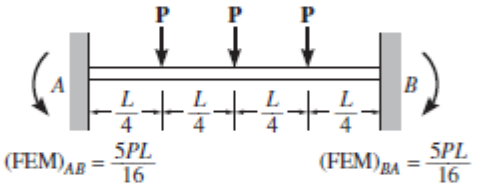
$(FEM)'_{AB} = (\frac{P}{L^2})(b^2a + \frac{a^2b}{2})$



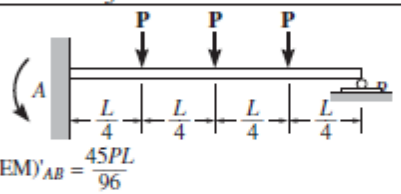
$(FEM)_{AB} = \frac{2PL}{9}$ $(FEM)_{BA} = \frac{2PL}{9}$



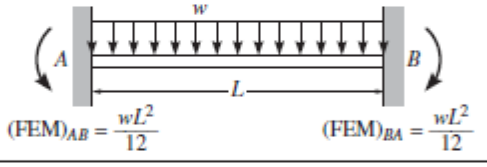
$(FEM)'_{AB} = \frac{PL}{3}$



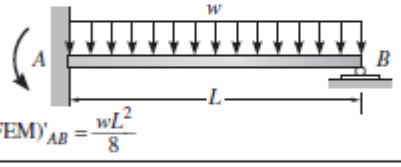
$(FEM)_{AB} = \frac{5PL}{16}$ $(FEM)_{BA} = \frac{5PL}{16}$



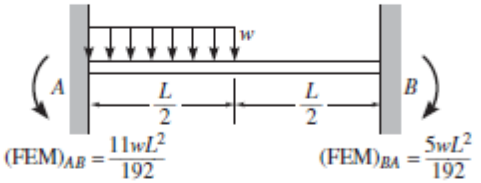
$(FEM)'_{AB} = \frac{45PL}{96}$



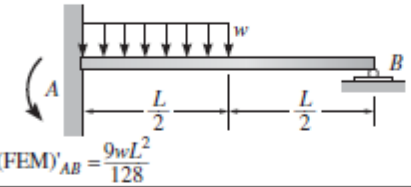
$(FEM)_{AB} = \frac{wL^2}{12}$ $(FEM)_{BA} = \frac{wL^2}{12}$



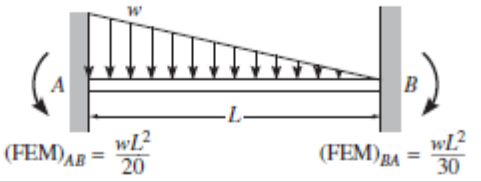
$(FEM)'_{AB} = \frac{wL^2}{8}$



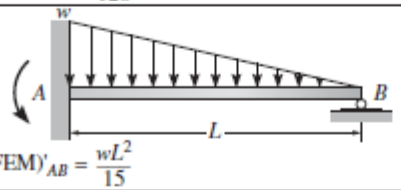
$(FEM)_{AB} = \frac{11wL^2}{192}$ $(FEM)_{BA} = \frac{5wL^2}{192}$



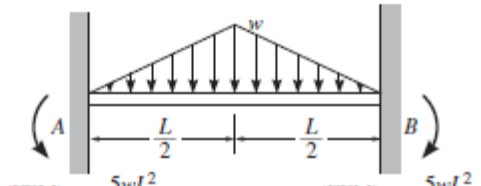
$(FEM)'_{AB} = \frac{9wL^2}{128}$



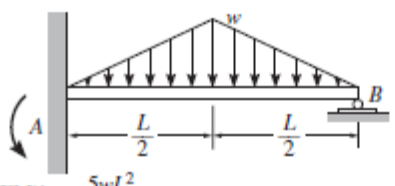
$(FEM)_{AB} = \frac{wL^2}{20}$ $(FEM)_{BA} = \frac{wL^2}{30}$



$(FEM)'_{AB} = \frac{wL^2}{15}$



$(FEM)_{AB} = \frac{5wL^2}{96}$ $(FEM)_{BA} = \frac{5wL^2}{96}$



$(FEM)'_{AB} = \frac{5wL^2}{64}$