Homework 5

(Due: December 9, 2020)

Question 1: 10 points

The beam structure shown in Figure 1 supports a uniformly distributed load w (N/m) between points B and C.

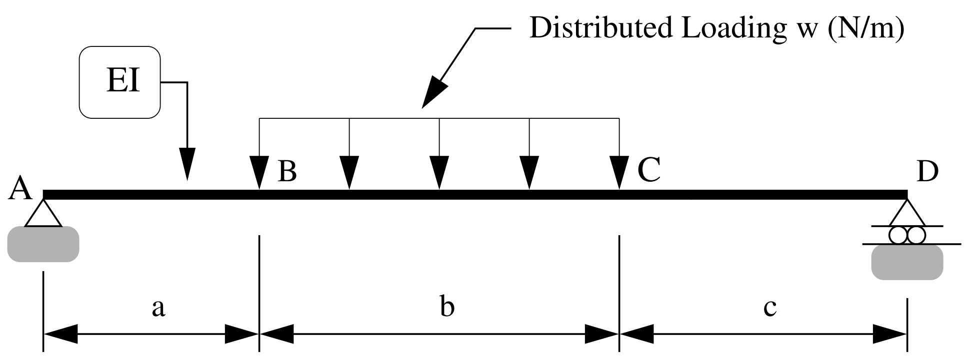

Figure 1: Front elevation view of a simple beam structure.

[1a] (4 pts) Use the method of **virtual displacements** to compute formulae for the vertical reactions at A and D. Show all of your working.

[1b] (6 pts) Use the method of **virtual displacements** to compute a formula for the bending moment at C. Show all of your working.

Question 2: 10 points

Figure 2 is a front elevation view of a simple truss that supports vertical loads at nodes C and D. All of the truss members have cross section properties AE.

[2a] (5 pts). Compute the support reactions and distribution of forces throughout the structure.

[2b] (5 pts). Use the method of **virtual forces** to show that the total deflection at node C is:

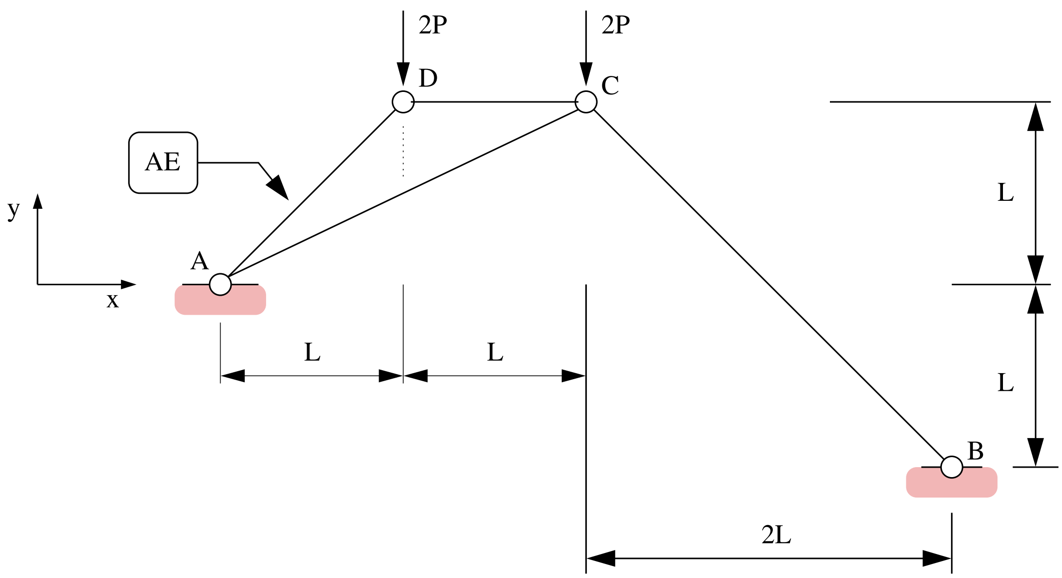

Figure 2: Front elevation view of a simple truss.

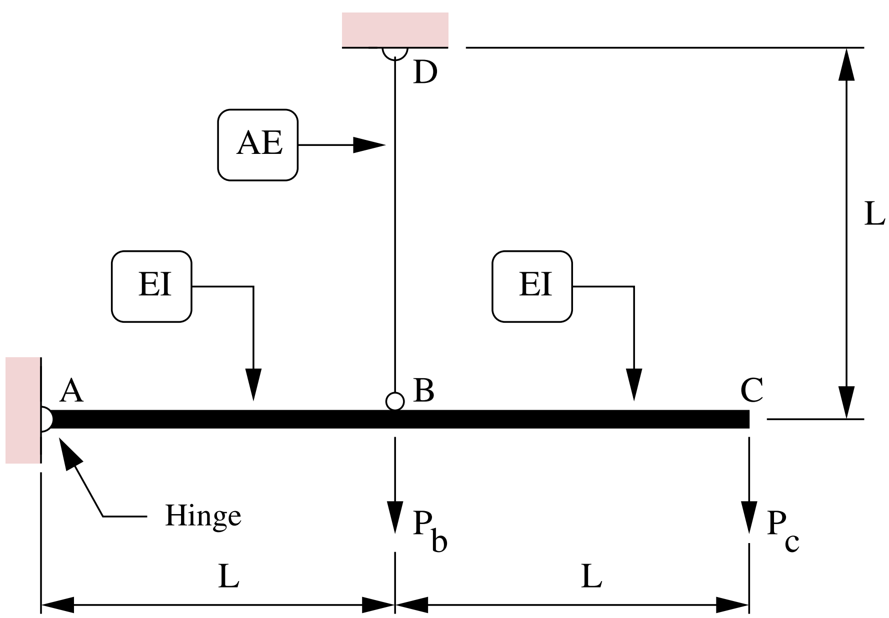

Figure 3: Front elevation view of a supported cantilevered beam structure.

$$\triangle = \frac{PL}{AE}\left[\frac{8\sqrt{10}}{3}\right]. \tag{1}$$

Question 3: 10 points

Consider the supported cantilevered beam structure shown in Figure 3. Use the principle of **virtual forces** to compute the two-by-two flexibility matrix connecting displacements at points B and C to applied loads P_b and P_c, i.e.,

$$\begin{bmatrix} \triangle_b \\ \triangle_c \end{bmatrix} = \begin{bmatrix} f_{11} & f_{12} \\ f_{21} & f_{22} \end{bmatrix} \begin{bmatrix} P_b \\ P_c \end{bmatrix}. \tag{2}$$