ENCE 353 Midterm II, Open Notes and Open Book

Name : _____

Exam Format and Grading. Partial credit will be given for partially correct answers, so please show all your working.

Question	Points	Score
1	5	
2	7	
3	8	
Total	20	

Question 1: 5 points

Consider the two-span beam structure shown in Figure 1.

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

[1a] (3 pts). Use the Muller-Breslau Principle to compute the influence line diagram for the vertical reaction at A.

[1b] (2 pts). Now suppose that span B-C carries a uniform load of w_o/L N/m. Using your influence line diagram from Part [1a], compute the vertical reaction at A.

Question 2: 7 points

The cable structure shown in Figure 2 carries a uniform load w_o N/m along its entire length.

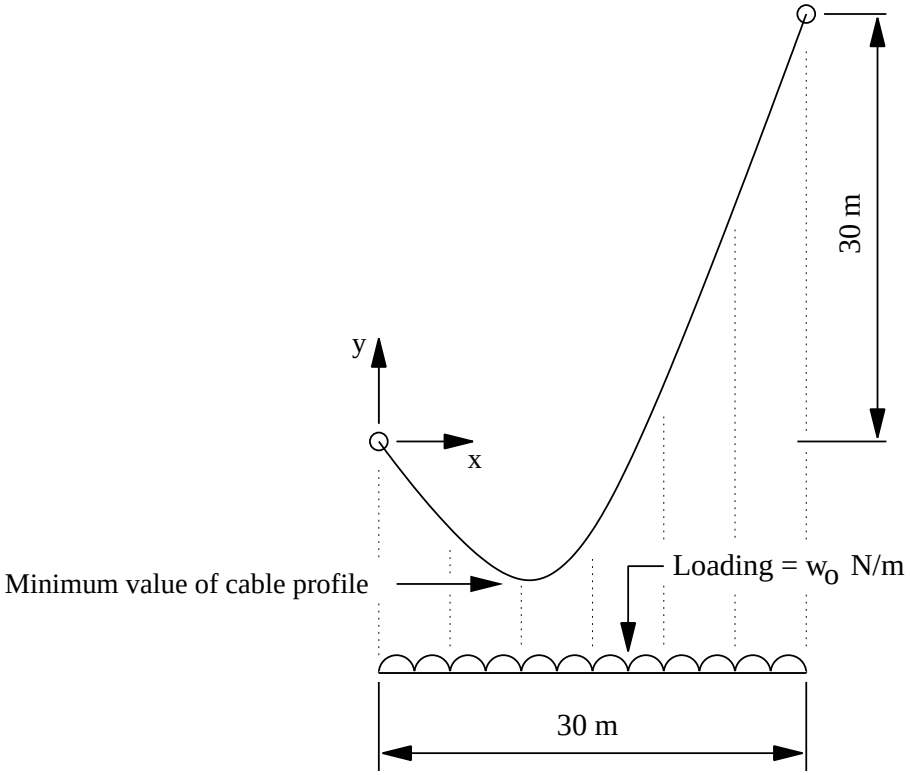

Figure 2: Elevation view of a pedestrian swing bridge.

[2a] (3 pts). Starting from first principles (i.e., the differential equation), show that cable profile is given by the equation

$$y(x) = \frac{w_o x^2}{2H} + \left(1 - \frac{15 w_o}{H}\right) x. \tag{1}$$

Now let us assume that the minumum value of the cable profile occurs at x = 10.

[2b] (2 pts). Show that the horizontal cable force is:

$$H = 5w_o. \tag{2}$$

[2c] (2 pts). Derive a simple expression for the maximum tensile force in the cable.

Question 3: 8 points

Consider the cantilevered beam structure shown in Figure 3.

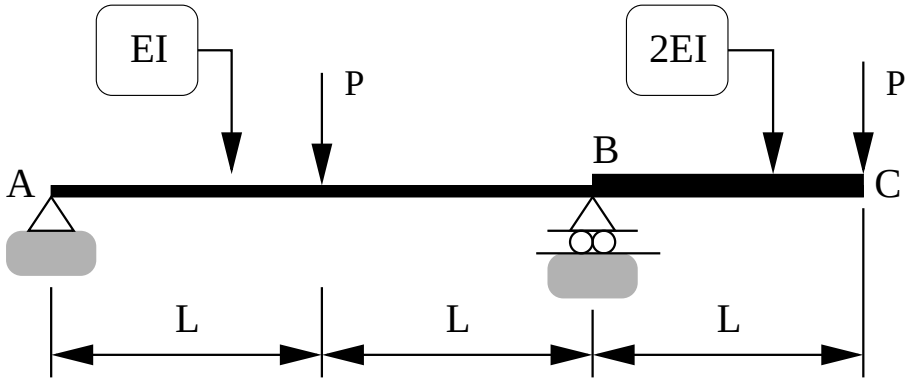

Figure 3: Front elevation view of a cantilevered beam structure.

Notice that segments A-B and B-C have cross-sectional properties EI and 2EI, respectively.

[3a] (2 pts) Compute and draw the M(x)/EI diagram for the complete beam A-B-C.

[3b] (2 pts) Draw and label a diagram showing how the rotation at A is related to the beam deflections at points B and C.

[3c] (2 pts) Use the method of moment-area to compute the vertical deflection of the beam at point C.

[3d] (2 pts) Draw and label a diagram of the deflected shape. Clearly indicate on your diagram regions of the beam having zero curvature.