QUIZ 1
Fall 2005-06
(Wednesday, November 9, 2005)
CIVE310 - MECHANICS OF MATERIALS
CLOSED BOOK, 1 ½ HOURS

Name: _____ **ID#:** _____

NOTES

- 2 PROBLEMS – 14 PAGES.
- ALL YOUR ANSWERS SHOULD BE PROVIDED ON THE QUESTION SHEETS.
- **TWO EXTRA SHEETS ARE PROVIDED AT THE END.**
- **ASK FOR ADDITIONAL SHEETS IF YOU NEED MORE SPACE.**
- SOME ANSWERS MAY REQUIRE MUCH LESS THAN THE SPACE PROVIDED.
- ***DO NOT*** USE THE BACK OF THE SHEETS FOR ANSWERS.
- DRAFT BOOKLET WILL BE PROVIDED; BUT DO NOT USE FOR ANSWERS.
- BOTH QUESTION SHEETS AND DRAFT BOOKLET SHOULD BE RETURNED.
- CHECK BOXES ARE FOR YOU TO CONFIRM THAT HAVE SOLVED A QUESTION ☑

YOUR COMMENT(S)

_ _

_ _

DO NOT WRITE IN THE SPACE BELOW

MY COMMENT(S)

_ _

_ _

YOUR GRADE

Problem I: _ _ _ /40
Problem II: _ _ _ /60
Other: _ _ _
_____

TOTAL: /100

Problem I: *(40 points)*

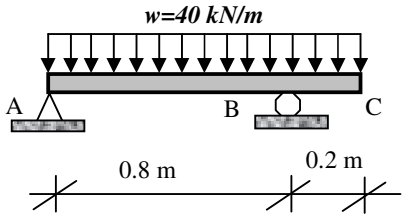

Figure I-a

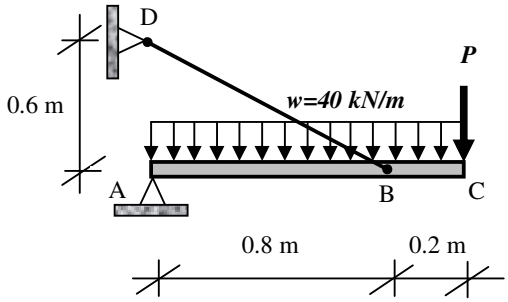

Figure I-b

Assume that the beam ABC and axial steel circular bar (or cable) BD in Figures I-a and I-b are weightless.

The properties and dimensions of the steel bar are as follows:

- $E = 200 \times 10^6$ kPa (kN/m^2) : Modulus of elasticity of steel
- $\sigma_y = 300{,}000$ kPa : Yield strength of steel in tension and compression
- $FS = 1.5$: Factor of safety
- $D = 2.5$ cm : Steel bar diameter

1. Referring to Figure I-a, draw the axial force, shear force, and bending moment diagrams for the beam ABC. (20 points) ☐

   Calculations and/or Diagrams:

Calculations and/or Diagrams (cont'd):

2. Referring to Figure I-b where Bar BD is used to replace the roller support at B:

   - For P=0, indicate, without calculations, which of the axial force, shear force, and bending moment diagrams will change from question 1. (4 points) ☐
   - For P=0, compute the force in the cable, and briefly discuss its safety. Determine the elongation of the cable. (8 points) ☐
   - Determine the maximum allowable load P that can be added at point C, assuming that the beam ABC will remain safe. (8 points) ☐

   Calculations and/or Diagrams:

Calculations and/or Diagrams (cont'd):

Problem II: *(60 points)*

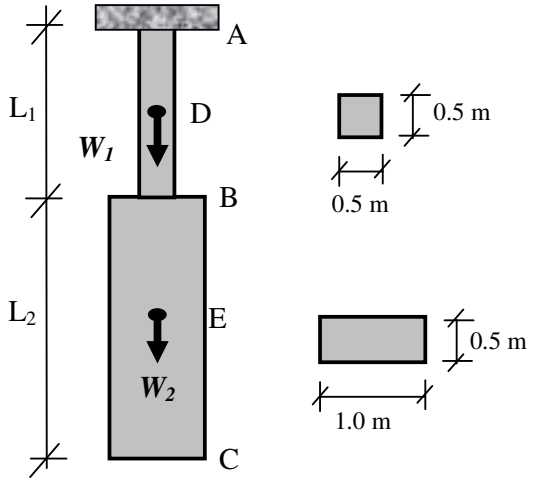

Figure II-a

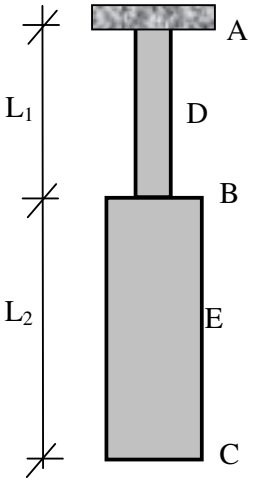

Figure II-b

The rectangular concrete member shown in Figure II has the following properties and dimensions:

- $E = 20 \times 10^6$ kPa (kN/m^2) : Modulus of elasticity
- $\gamma = 25$ kN/m^3 : Weight density
- *Part [AB]:* $L_1 = 2.0$ m $A_1 = 0.5$ m x 0.5 m Weight = W_1
- *Part [BC]:* $L_2 = 3.0$ m $A_2 = 1.0$ m x 0.5 m Weight = W_2

1. ***Using Equivalent Concentrated Own Weights W_1 and W_2*** applied at centroids of parts [AB] and [BC], respectively, as shown in Figure II-a:
   - Draw the axial force, stress, strain and displacement diagrams. (17 points)
   - Compute the axial stiffness of the bar. (3 points)

   Calculations and/or Diagrams:

Calculations and/or Diagrams (cont'd):

2. ***Using Actual Distributed Own Weight as shown in Figure II-b:***

- Calculate the axial stress at points A and E and compare with results obtained in question 1. (7 points) ☐
- Calculate the vertical displacement of point C. Compare with question 1 and briefly discuss. (15 points) ☐
- Compute the axial stiffness of the bar. (3 points) ☐

Calculations and/or Diagrams:

Calculations and/or Diagrams (cont'd):

3. The bar system in Figure II-a is now fixed at C and A as shown in Figure II-c. Compute the support reactions at A and C. (15 points) ☐

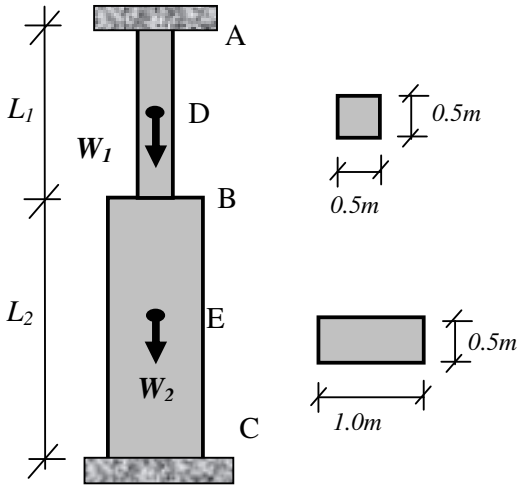

Figure II-c

(THINK BEFORE YOU SOLVE: THIS MAY SAVE YOU QUITE SOME TIME)

Calculations and/or Diagrams (cont'd):

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EXTRA SHEET: Continued from page _____

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