

QUIZ 1
Fall 2004-2005
(Wednesday, November 10, 2004)
CIVE310 - MECHANICS OF MATERIALS
CLOSED BOOK, 1 ½ HOURS

Name: _____

ID#: _____

NOTES

- 2 PROBLEMS – 12 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)

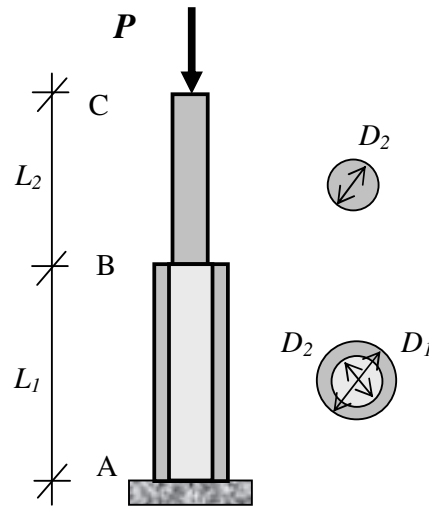
YOUR GRADE

Problem I: ___ /75

Problem II: ___ /25

Other: ___

TOTAL: /100

Problem I: (75 points)**Figure I**

The circular steel tube shown in Figure I has the following properties and dimensions:

- $E = 200 \times 10^6$ kPa (kN/m²) : Modulus of elasticity
 - $\gamma = 80$ kN/m³ : Weight density (about 8 times water)
 - $\sigma_y = 255,000$ kPa : Yield strength in tension and compression
 - $FS = 1.5$: Factor of safety
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- $L_1 = 1.2$ m $L_2 = 0.8$ m
 - $D_1 = 0.05$ m $D_2 = 0.03$ m

2. **AGAIN IGNORING THE OWN WEIGHT** with $P = 120 \text{ kN}$ and referring to question 1. In order to achieve the most economical and safe solution for optimum design, determine the minimum thickness “ t ” required for segment AB by varying the outer diameter D_1 while keeping the inner diameter $D_2 = 0.03 \text{ m}$. (15 points)



Calculations and/or Diagrams:

Calculations and/or Diagrams (cont'd):

A series of horizontal dashed lines provided for calculations and diagrams.

3. **CONSIDERING OWN WEIGHT ONLY** with $P = 0$, and referring to the original properties and dimensions as in question 1.
- Compute the maximum stress and its location, and comment on safety. *(15 points)*
 - Compute the top displacement at C and the stiffness of the system. *(15 points)*

Calculations and/or Diagrams:

Calculations and/or Diagrams (cont'd):

Dotted lines for calculations and diagrams.

Problem II: (25 points)

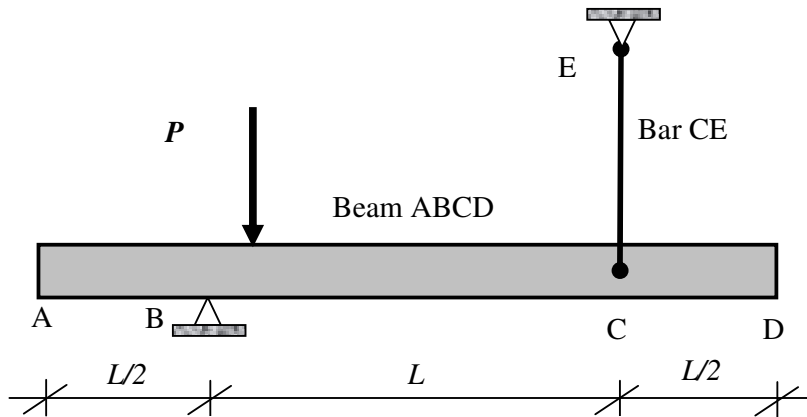


Figure II

Referring to the beam-bar system shown in Figure II, the concentrated downward vertical force P is a moving load, and can assume any position on the beam between A and D. **Ignore the own weights of the beam and bar.**

Determine the positions of the load P and compute the corresponding force in Bar CE, for the following cases:

- Maximum Tension in Bar CE.
- Maximum Compression in Bar CE.
- Force in Bar CE is equal to P in tension.

Note: You should compute one position and corresponding force for each of the cases above.

Calculations and/or Diagrams:

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