QUIZ 2
Fall 2001-2002
(Monday, January 14, 2002)
CVEV 041 – MECHANICS OF MATERIALS
CLOSED BOOK, 1 ½ HOURS

Name: _____ **ID#:** _____

NOTES

- ALL YOUR ANSWERS SHOULD BE PROVIDED ON THE QUESTION SHEETS.
- **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.

YOUR COMMENT(S)

_ _

_ _

DO NOT WRITE IN THE SPACE BELOW

MY COMMENT(S)

_ _

_ _

YOUR GRADE

Problem I: _ _ _ /50
Problem II: _ _ _ /50
Other: _ _ _
_____

TOTAL: /100

Problem I: *(50 points)*

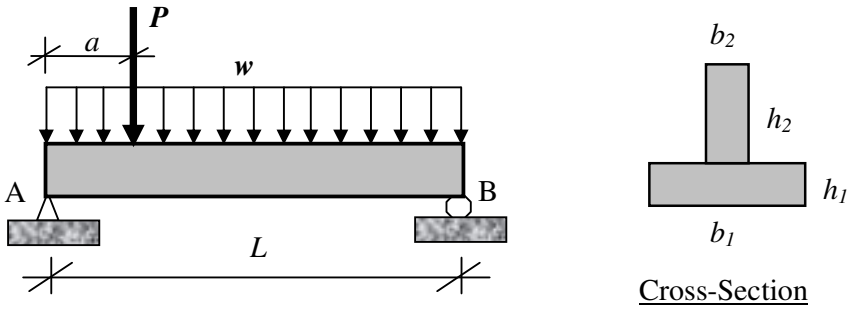

Figure I

A simply supported beam is loaded as shown in Figure I. The cross-section dimensions are also shown in the figure. Assume linear elastic behavior and that the beam is safe in shear.

The ***dimensions*** of the beam are given as follows:

- L = 6 m
- b_1 = 0.60 m b_2 = 0.20 m
- h_1 = 0.20 m h_2 = 0.40 m

The following are the ***properties*** of the system:

- E = 20 x 10^6 kPa (kN/m^2) : Modulus of elasticity
- σ_{YT} = 10000 kPa : Yield stress in tension
- σ_{YC} = 20000 kPa : Yield stress in compression

The following ***loads/weights*** are to be considered:

- w = 25 kN/m : Distributed own weight of the beam
- P = 100 kN : Moving load positioned at "a" between (A) and (B)

1. Determine the moment capacity of the section. (*15 points*)

Calculations and/or Diagrams:

2. Let P be applied at $a = L/4 = 1.5$ m
   Draw the shear and bending moment diagrams in the beam. (*10 points*)
   Show the stress distribution due to bending on the critical cross section, and discuss the safety of the beam for bending. (*10 points*)

Calculations and/or Diagrams:

Calculations and/or Diagrams (cont'd):

3. Discuss the beam safety for a worst-case condition of *P*. Show that condition. *(15 points*)

Calculations and/or Diagrams:

Problem II: *(50 points)*

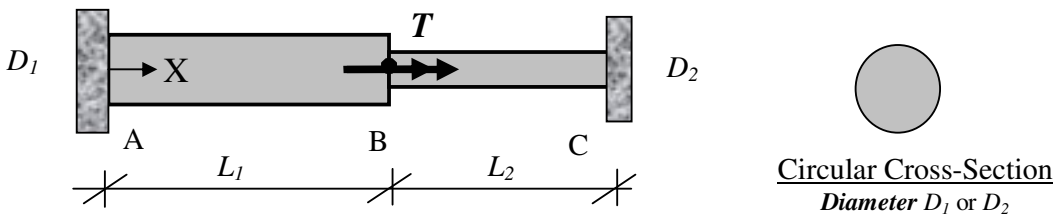

Figure II

The circular shaft shown in Figure II is indeterminate to the first degree. Assume linear elastic behavior and neglect the own weight of the shaft.

The ***dimensions***, ***properties*** and ***torque*** load of the shaft are given as follows:

- L_1 = 3 m L_2 = 2 m
- D_1 = 0.50 m D_2 = 0.30 m
- G = 10 x 10^6 kPa (kN/m^2) : Shear modulus of elasticity
- T=50 kNm : Torque applied at B

1. Solve for the angle of rotation at B. *(15 points)*
   Compute and draw the shear stress distribution at B. *(10 points)*

   Calculations and/or Diagrams:

Calculations and/or Diagrams (cont'd):

2. The shaft was subjected to an experiment and the maximum shear strain at a section just to right of B was measured as 0.0001535.
   Compute the reactions of the shaft and the angle of rotation at B. Compare with question 1 and briefly comment. (*15 points*)

   Calculations and/or Diagrams:

3. What is the uniform diameter D of a shaft of total length (5 m) which will give the same angle of rotation at B computed in question 1. Compare D to D_1 and D_2, and very briefly comment. (*10 points*)

   Calculations and/or Diagrams:

EXTRA SHEET: Continued from page _____

Name: _____ **ID#:** _____

Calculations and/or Diagrams:

EXTRA SHEET: Continued from page _____

Name: _____ **ID#:** _____

Calculations and/or Diagrams: