QUIZ 1

Spring 2006-2007

(Wednesday March 28, 2007)

CIVE311 – STRUCTURES I

CLOSED BOOK, 1 & 1/2 HOURS

Name: N N **ID#:** [redacted]

NOTES

- 1 PROBLEM – 4 QUESTIONS – 12 PAGES.
- ALL YOUR ANSWERS SHOULD BE PROVIDED ON THE QUESTION SHEETS.
- **TWO EXTRA SHEETS IS 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 TO CONFIRM THAT YOU HAVE SOLVED A QUESTION. ☑

YOUR COMMENT(S)

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_ _

DO NOT WRITE IN THE SPACE BELOW

MY COMMENT(S)

_ _

_ _

YOUR GRADE

Problem I-1:	30	/30
Problem I-2:	35	/35
Problem I-3:	15	/15
Problem I-4:	20	/20
Other:		
TOTAL:	100	/100

Problem I/I: *(100 points = 30 + 35 + 15 + 20)*

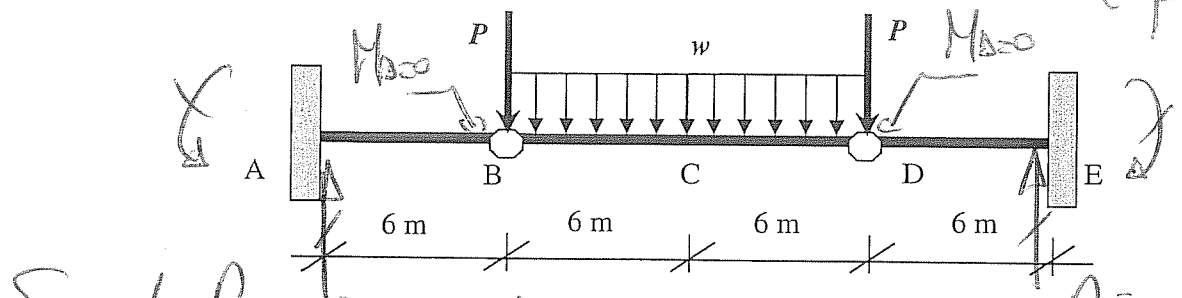
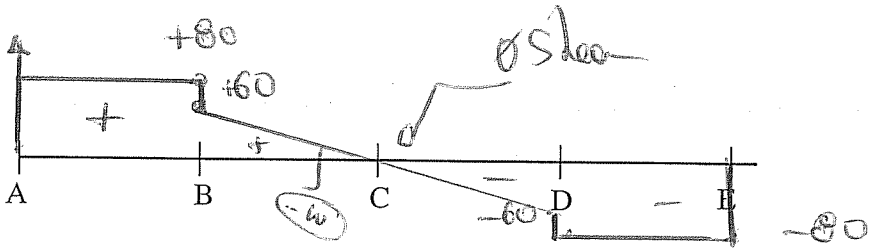


Figure I

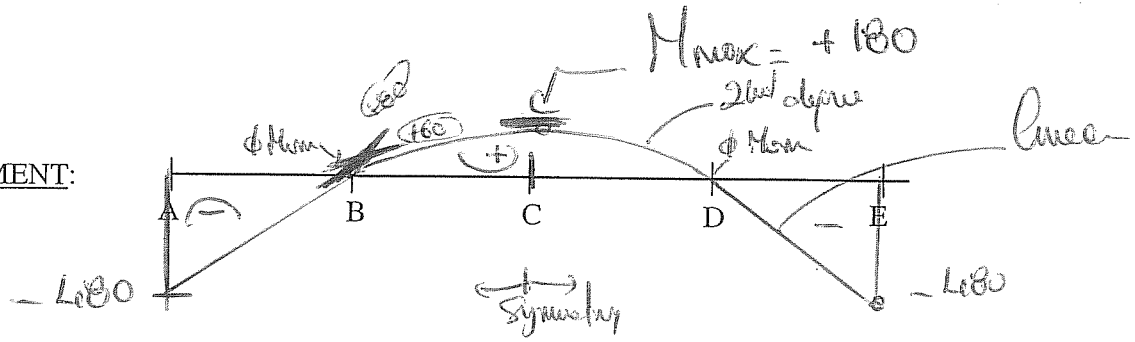
For the beam shown in Figure I, the own weight is neglected.
Your diagrams/sketches should include any feature/value you think is relevant or important.

1. Let w=10 kN/m and P=20 kN
   Compute the ***reactions*** (forces and moments) in the beam, and draw the ***shear*** and bending ***moment*** diagrams; sketch the ***deflected shape***. *(20 points)*
   Can you compare the middle part BD, to a simpler beam? Draw this beam and briefly explain (no need for calculations; restrict your answer to a sketch of the beam and 2-3 lines of explanation). *(5 points)*
   Can you compare the end parts BD or ED to a simpler beam? Draw this beam and briefly explain (no need for calculations; restrict your answer to a sketch of the beam and 2-3 lines of explanation). *(5 points)*

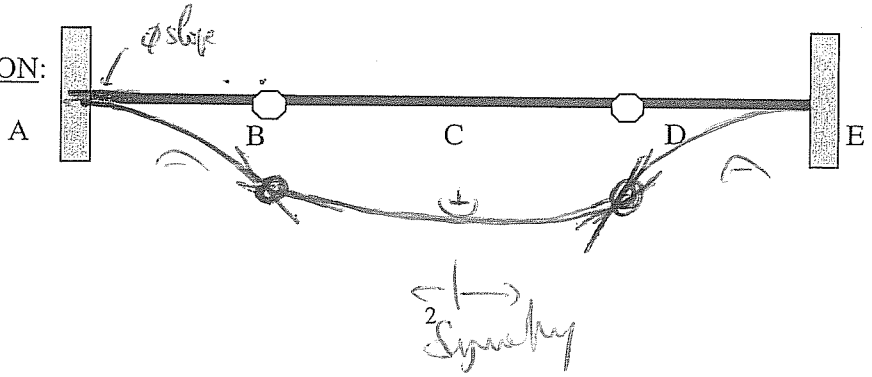
SHEAR:



MOMENT:



DEFLECTION:



Calculations and/or Diagrams (cont'd):

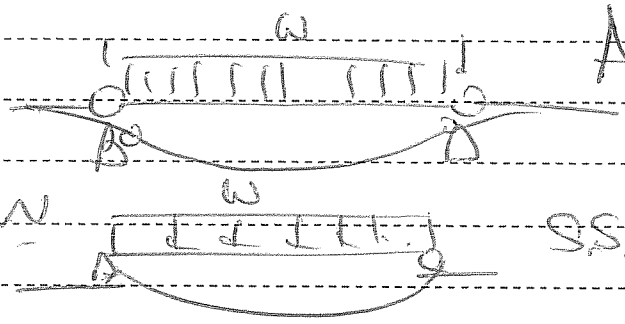
Symmetry $\uparrow R_A = R_E = P + \frac{w \times 12}{6} = 80\,kN$

$\circlearrowleft M_B = 0 \Rightarrow M_A = 80 \times 6 = 480\ kN\,m$

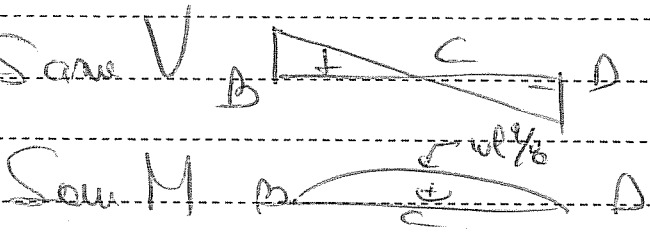
$M_E = 480\ kN\,m$

$R_A = 80$

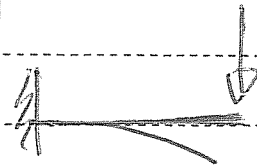
Part BD



- BD behaves like a simply supported Beam supported on the two edge parts.

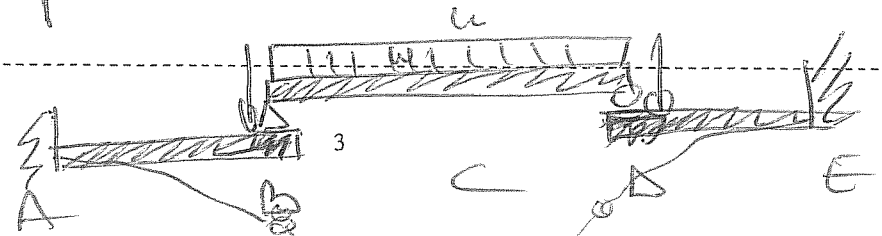


- AB (or ED) behave like the a simple cantilever part (fixed Free)



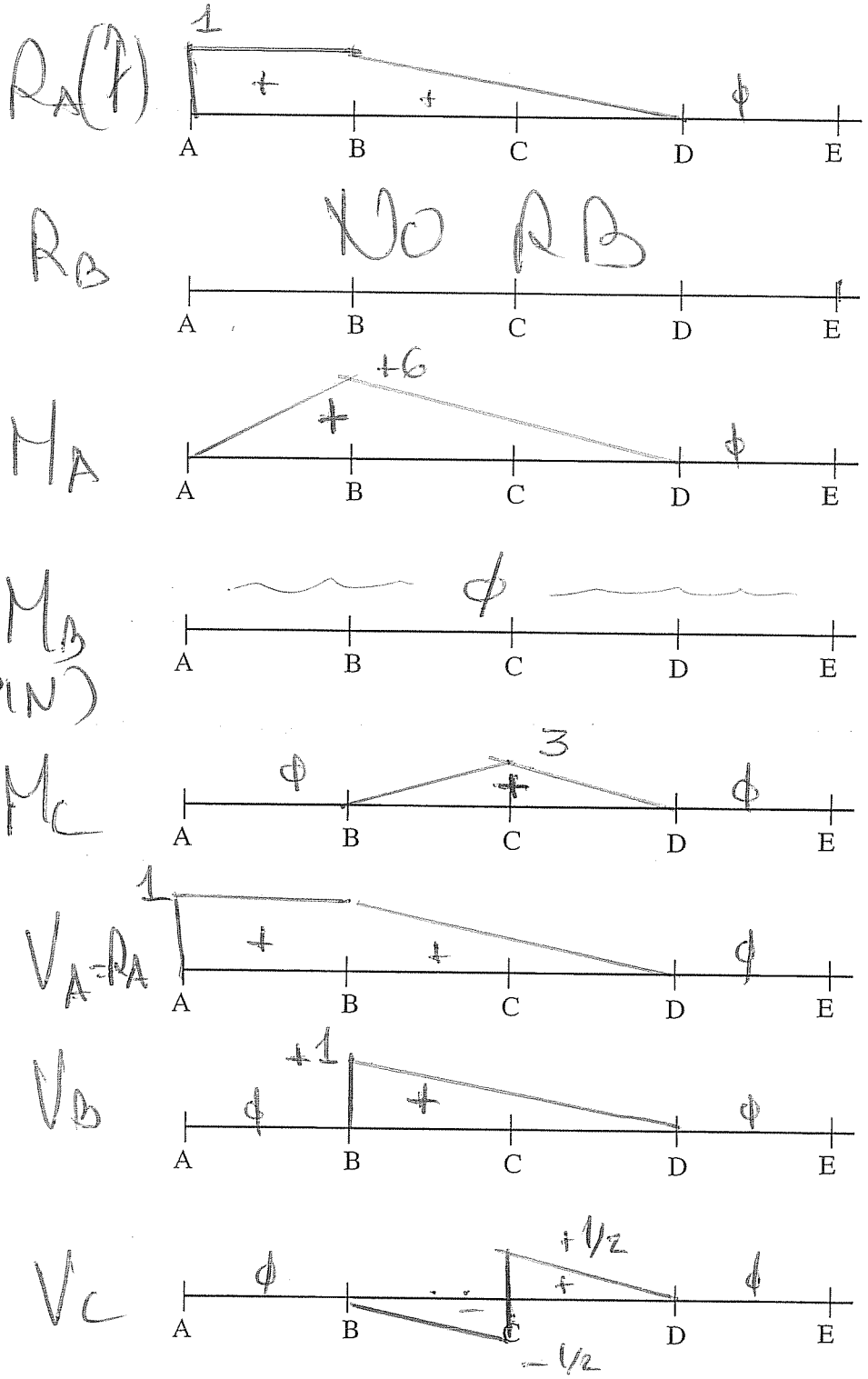
- loaded by $P = \frac{1}{2} \times (w \times 12)$ from the simple part

Both →



2. Referring to Figure I, draw the influence lines for R_A, R_B, M_A, M_B, M_C, V_A, V_B, and V_C. Draw in the order which you find appropriate. *(35 points)*

Calculations and Diagrams:



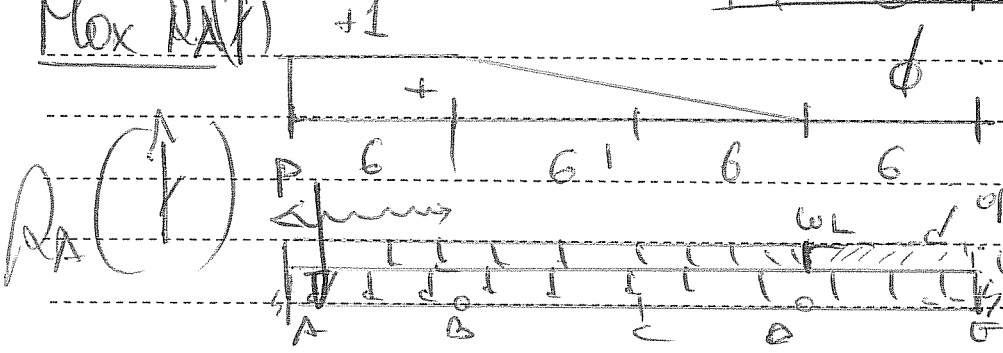
3. Let w_D=10 kN/m (dead load); w_L=10 kN/m and P=20 kN (live loads)
   - Compute the maximum value(s) for R_A and V_C, and show the corresponding loading position (s). *(10 points)*
   - Compute R_A for w_L on BCD only and P on B and D and compare with question 1 (do not include w_D). *(5 points)*

Calculations and Diagrams:

$Max\ (+)R_A = 260$ kN

$Max\ (\pm)V_C = 25$ kN

Max (+) R_A



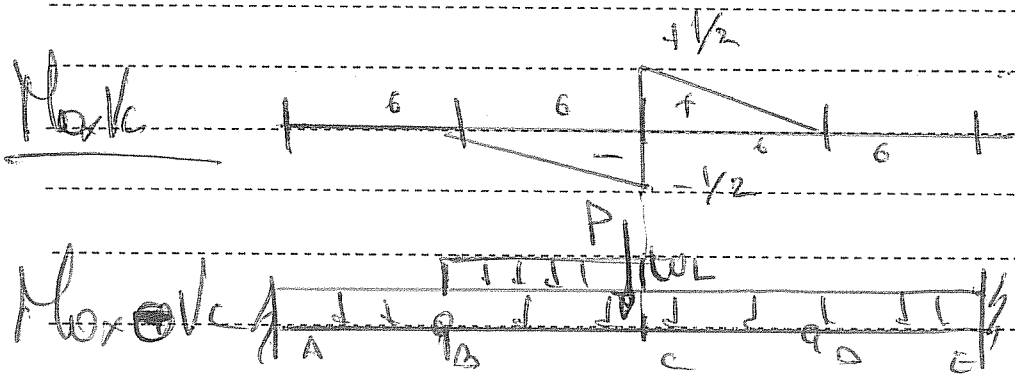
$Max\ (+)R_A = (10+10)\left(1\times 6 + 1\times\frac{12}{2}\right) = 260$ kN ↑

$+\ 20\times 1$

$Max\ (-)R_A = 10 \times 12 = 120$ kN ↓ (w_D)

No Max (−) R_A

Max V_C



$w_D \longrightarrow \phi$

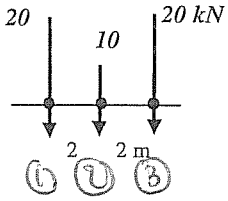
$Max\ (-)V_C = 10\times\left(-\frac{1}{2}\times 6\times\frac{1}{2}\right) + 20\left(-\frac{1}{2}\right)$

$= -25$ kN

$Max\ (+)V_C = |Max\ (-)V_C| = 25$ kN

R_A (w_L on BCD + P on B/D) $= 10\times 6 + 20\times 1 = +80$ kN ↑ (uplift)

4. Compute the maximum value(s) of M_C for the truck load shown below, and show the corresponding position(s) of the truck. *(10 points)*
Compute the maximum absolute moment that can ever occur between B and D for the truck load shown below. Compare with maximum M_C and briefly comment *(10 points)*



Calculations and Diagrams: