

CIE302 Structural Analysis I (Fall 07), Test #1

Closed Book, 60 Minutes
16-Nov-07

Important Notes:

- ✓ Every FBD needed for the solution of a problem should be clearly drawn. Points will be deducted for equilibrium equations that do not have a corresponding FBD or an incomplete/incorrect FBD.
- ✓ Show all your calculations. Points will be deducted for answers that are not supported by proper calculations.
- ✓ Use the Virtual work method to determine all displacement. No points will be given for any other method.
- ✓ Ignore shear deformations.
- ✓ Use the Virtual structure as specified in the problem. No points will be given for using a different Virtual structure.
- ✓ All members have the same E and I.

Problem 1 (25 points)

Determine (a) the deflection at C, (b) the rotation at C and specify their directions. Use Virtual = Real Structure.

Problem 2 (25 points)

Members AB and BC are connected by a pin at B. Determine (a) the vertical deflection at B, (b) the horizontal deflection at B and specify their directions. Use Virtual = Real Structure.

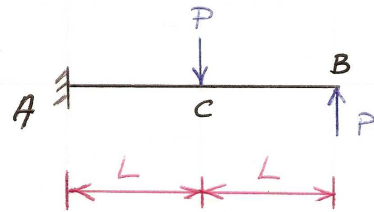
Problem 3 (25 points)

Determine (a) the vertical deflection at B, (b) the vertical deflection at E and specify their directions. Use Virtual = Real Structure.

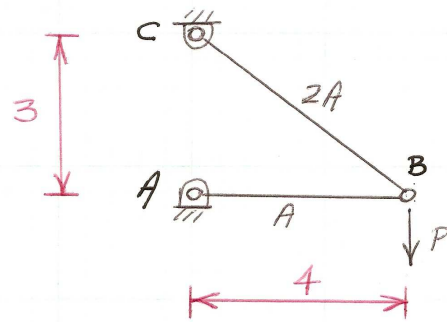
Problem 4 (25 points)

Members AE and BE are connected by a pin at E. Determine the reactions at A.

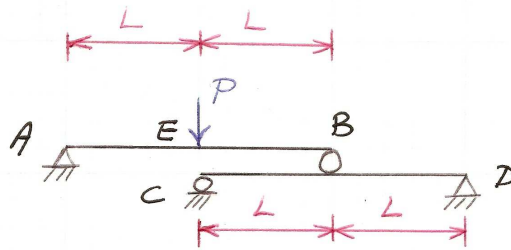
1.



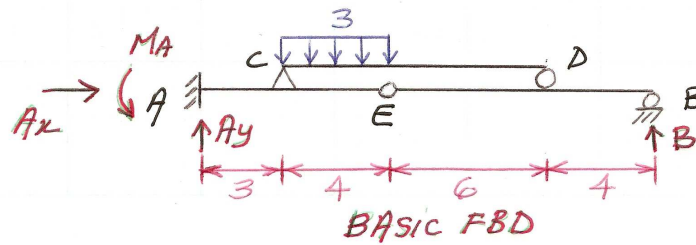
2.



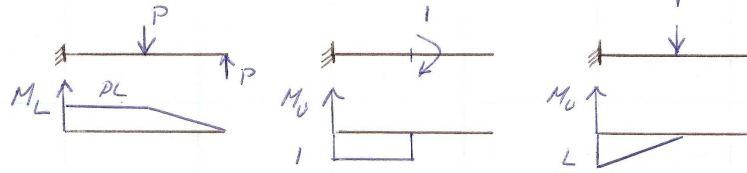
3.



4.



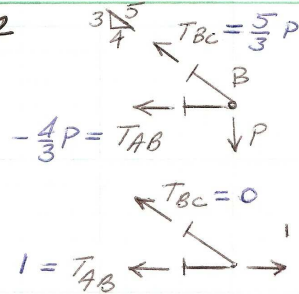
1.



$$(1) \Delta_C = \frac{L}{6EI} (-2 \times L \times PL) ; \Delta_C = \frac{PL^3}{2EI} \uparrow$$

$$(1) \theta_C = \frac{-(1)(PL)}{EI} L ; \theta_C = \frac{PL^2}{EI} \rightarrow$$

2.

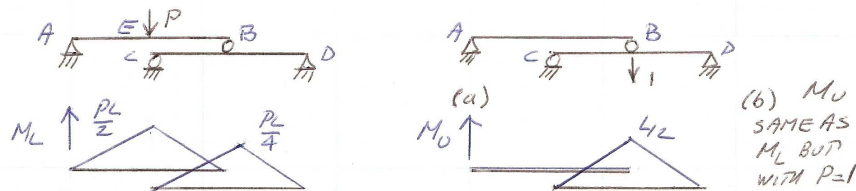


MEMBER	L	A	P_L	P_U	P_D
AB	4	A	$-\frac{1}{3}P$	$-\frac{1}{3}$	1
BC	5	2A	$\frac{5}{3}P$	$\frac{5}{3}$	0

$$(1) \Delta_B = \frac{(-\frac{1}{3})(-\frac{1}{3}P)(4) + (\frac{5}{3})(\frac{5}{3}P)(5)}{EA \cdot (4) + E(2A)(5)} = \frac{253P}{18EA}$$

$$(1) \Delta_B = \frac{(1)(-\frac{1}{3}P)(4)}{EA} = -\frac{16P}{3EA}$$

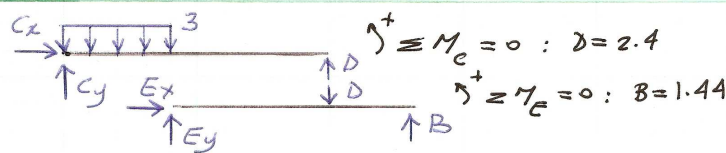
3.



$$(1) \Delta_B = \frac{L}{6EI} (2 \times \frac{L}{2} \times \frac{PL}{2}) \times 2 ; \Delta_B = \frac{PL^3}{12EI} \downarrow$$

$$(1) \Delta_E = \frac{L}{6EI} (2 \times \frac{L}{2} \times \frac{PL}{2}) \times 2 + \frac{L}{6EI} (2 \times \frac{L}{2} \times \frac{PL}{2}) \times 2 ; \Delta_E = \frac{5PL^3}{24EI} \downarrow$$

4.



BASIC FBD : $\sum F_x = 0 : A_x = 0$, $\sum F_y = 0 : A_y = 10.56$

SEE QUESTION SHEET $\sum M_A = 0 : M_A = 35.52$