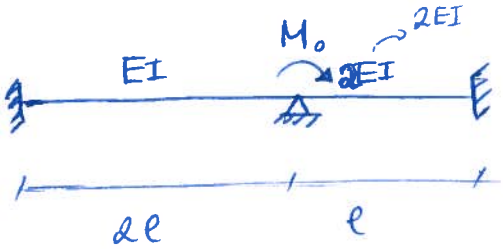
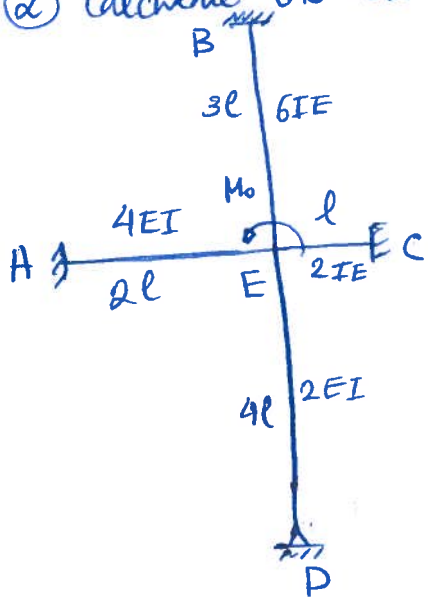
Homework 7 :

① calculate the rotation at point B : [use 1st Castigliano's theorem].



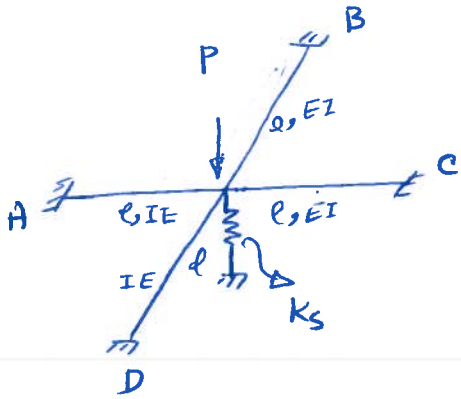
② Calculate the rotations at point D and E : (negled axial deformations).

[use Castigliano's 1st theorem]



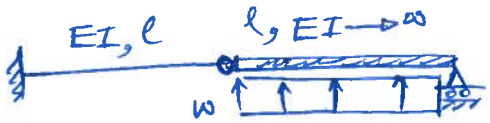
③ Calculate the deflection at point O: [the structure is planar].

[use Castigliano's 1st theorem].

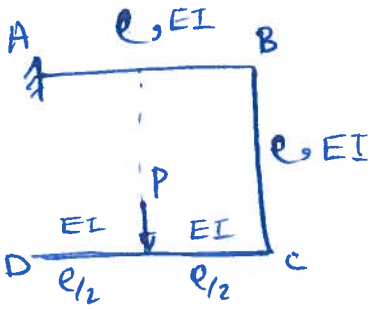


[Hint : the structure is symmetric and the spring add an energy term equal to $\frac{1}{2} K_s \Delta^2$]

④ Calculate deflection at point B using Castigliano's 2nd theorem: [neglect shear].

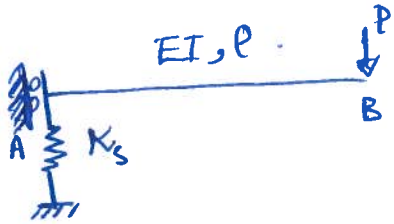


⑤ Calculate the rotation at point D using 2nd Castigliano's theorem [neglect shear]



⑥ Calculate the deflection at point B using 2nd Castigliano's theorem.

[neglect Shear].

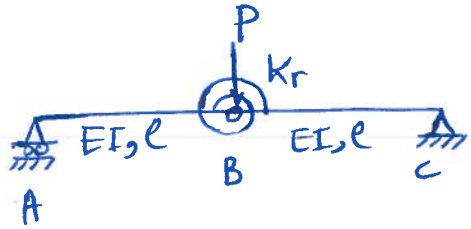


[Hint: the energy in spring is

$$\frac{1}{2} K_s \Delta^2 = \frac{1}{2} \frac{P^2}{K_s}$$]

⑦ Using 2nd Castigliano's theorem, calculate the deflection at point B:

[neglect Shear].



[Hint: the energy in rotational spring is:

$$\frac{1}{2} K_r \theta^2 = \frac{1}{2} \frac{M_s^2}{K_r}$$]