

**College of Maritime Engineering, and Biological, Oceanical and
Natural Resource Sciences**

Introduction to the Study of Structures

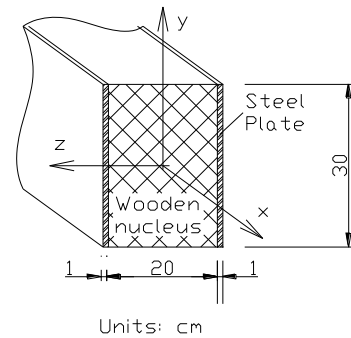
2nd Evaluation

February 17, 2017

Student:

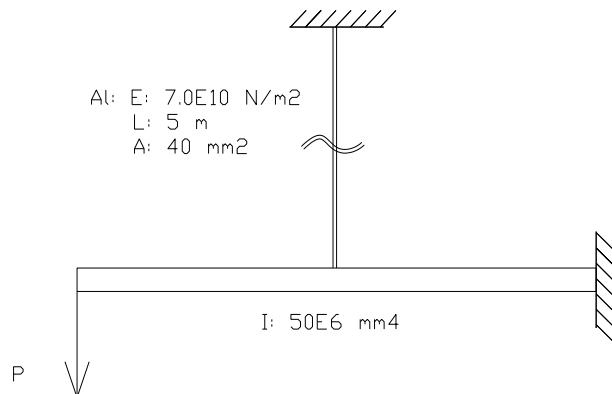
1.- The transversal section of a beam is formed by a 20x30 cm wooden nucleus, and reinforced by two steel plates 1 cm thick, as shown in the figure. Calculate the *bending stiffness* of the beam:

$$(EI) = \iint E(y, z) y^2 dA.$$



Then, if the permissible stress of the wood is 9.40 N/mm², determine the maximum bending moment $M_{z_{max}}$ that may be supported by the beam. For the wood, take E_{wood} : 9.41E3 N/mm². (25)

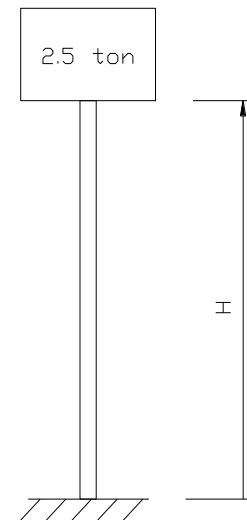
2.- To reduce the deflection at the end of a 4 meter long clamped steel beam, a vertical aluminum bar is installed, as shown in the attached figure. Determine the final deflection at the end of the beam, if a P force 1000 N is applied downwards. (30)



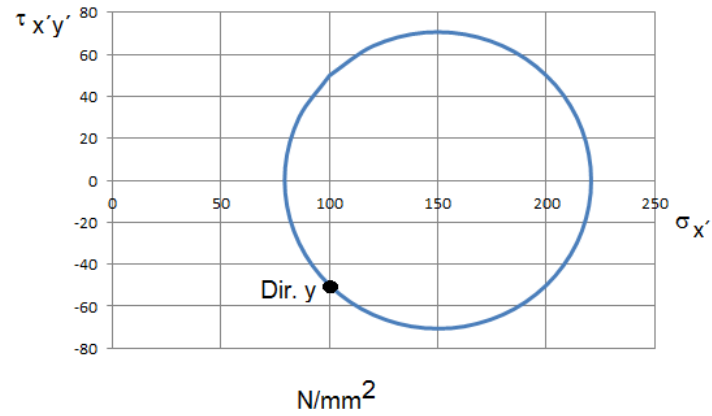
3.- An elevated tank is supported by a steel vertical tube (D_{ext} : 141.3, D_{int} : 128.2 mm) as shown in the figure. Combining the tank and the contained water they weight 2.5 tons.

i. Determine the critical buckling load of the column.

ii. If the required buckling safety factor is 2.5, what is the maximum height H at which the tank may be installed? (25):



4.- Using strain gages it has been determined the Mohr's circle in plane stress at a point of a structure. In the attached figure, stress components in the y-direction are shown:



Prepare a sketch in the way this structure would fail, if the applied forced would increase slowly. (20)

jrml/17

I certify that during this examination I have complied with the *Code of Ethics of ESPOL*:

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