**College of Maritime Engineering and Sea Sciences**

**Ship's Structure**

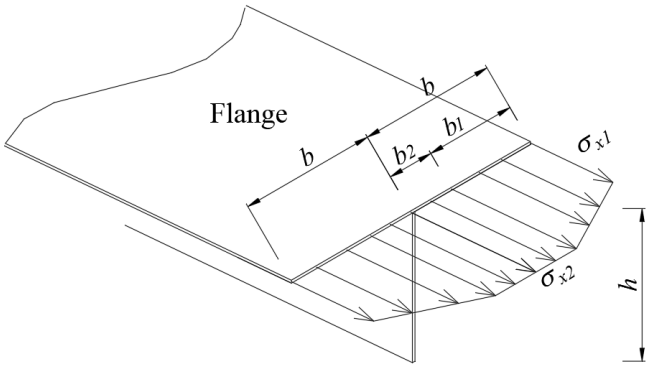
**Second Quiz: Shear stress in bending & Energy methods** **July 5th, 2022**

**Open books**

**1.** In a beam built from a steel flat bar (width *b* and thickness *t*) seated on the side of the thickness, it is applied a shear force. If the yield point in shear of the material is 115 MPa, deduce an expression for the maximum force that may be applied on the section, calling *A* the total area of the section.

a. 230 *A* / 3
b. 235 *A*
c. 115 *A*/Saf.Fac.
d. 230 *A*

**2.** After calculating the bending to a lateral load of the combination of a vertical stiffener welded to a horizontal plate, the following stress distribution with trapezoidal shape is obtained:



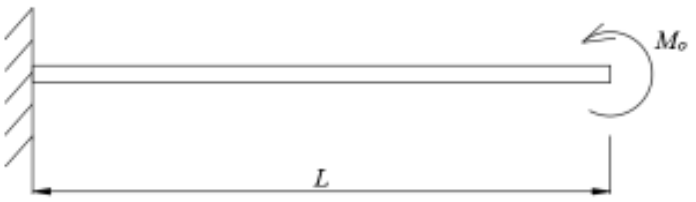

Calculate the effectiveness of the flange considering that the material is steel (*t*= 8 mm, *b*=30cm, $b_1$=20cm, *h*=70cm, and $\sigma_{x1}$=100, and $\sigma_{x2}$=150 N/mm$^2$).

a. 89%
b. 84%
c. 79%
d. 74%-

**3.** From the following statements, which one is true?

a. Units of the potential work that may be developed by the external forces are [M(L/T)$^2$].
b. The work developed by the external forces, is a function which can take only positive values.
c. The strain energy can have positive or negative values.
d. In beam bending, if the normal stress $\sigma_x$ is negative, strain energy is also negative.

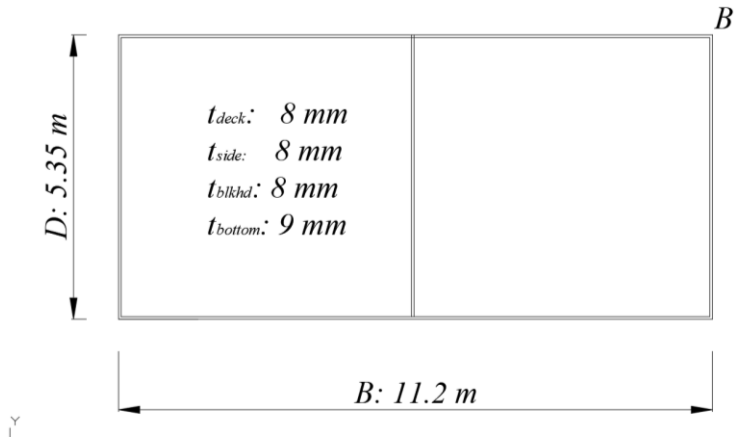
**4.** Applying an energy method, calculate the slope of the end of the clamped beam, with a concentrated moment on the right end:




a. $\theta(L)=M_o L / (E I_c)$
b. $\theta(L)=M_o L^2 / (E I_c)$
c. $\theta(L)=M_o L^2 / (3E I_c)$
d. $\theta(L)=M_o L / (3E I_c)$

**Problems**

**1.** After completing the analysis of a steel barge which has one longitudinal bulkhead located at the center line, it was determined that shear stress on the deck at the connection with the side is 27.9 MPa. The shear force applied on the section is 5 MN. The section has an inertia of 1.67 m4 and vertical position of the neutral axis is 2.58 m from the bottom. Determine the point on the deck measured from the corner B where the shear stress is null.




**2.** You are asked to apply Rayleigh-Ritz method to approximate the deflection function of the clamped beam with a spring of stiffness $K$ on its right end. The beam is prismatic with bending rigidity equal to $EI_c$ and length $L$. Use the following function to approximate the solution when a concentrated force $F$ is applied at point $x=a$ of the beam:

$$\tilde{v}(x) = a_1 x^2 \left(\frac{8x}{10} - L\right)$$