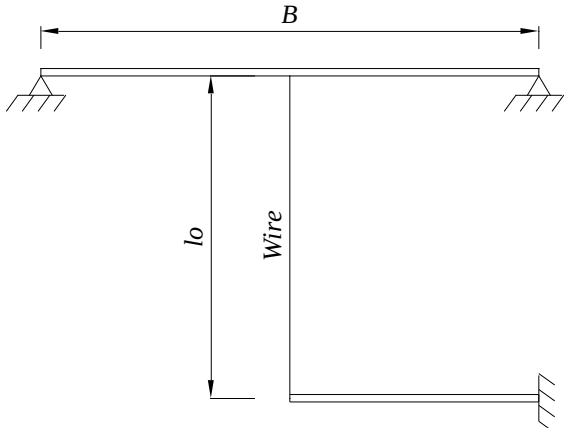
Faculty of Maritime Engineering and Marine Sciences

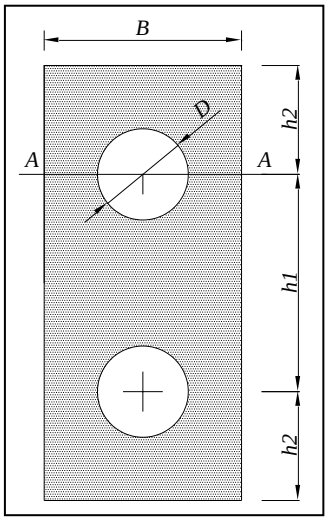
Ship's Structure

Quiz 5 – Comprehensive evaluation **September 25th, 2020**

Group 1 (Review on beam bending).
Two horizontal beams are connected by a vertical wire, from the mid span of the simply supported upper to the end of the clamped lower, as shown in the figure. The wire suffers a temperature drop of 31.25ºC, and it is desired to calculate the force which is exerted on the upper beam. The wire has the following characteristics: *lo*: 5.08 m, E_{wire}: 2.11E10 kg/m^2, A_{wire}: 0.0003 m^2, and, thermal expansion coefficient: 1.04E-5 1/ºC. Dimension *B*: 1.52 m, and both beams have the following characteristics: *E*: 1.06E9 kg/m^2 and *Ic*: 5.00E-6 m^4. Express your answer in kilograms.



Group 2 (Shear in bending).
Calculate the maximum shear force that may be applied on the following beam section considering the stress at level AA. The section corresponds to a cast steel beam with two circular holes to save weight. Dimensions are: *B*: 5 cm, *h1*: 3 cm, *h2*: 6 cm, and, diameters of the holes *D*: 4 cm. The allowable stresses that may be developed on the material are: normal: 120 N/mm^2 and shear: 55 N/mm^2. Express your answer in Newton.



Group 4 (Hull beam bending)
Consider the bending of a simplified ship hull, with quadratically distributed beam and vertical sides: $B(x) = B\left[1-(2x/L)^2\right]$, where *B* is the beam at amidships and *L* is the length of the ship. The lightship weight distribution is represented with the following function $w_{light} = 100\left[1-(x/L)^2\right], kN/m$. For both functions the origin is located at amidships, with positive *x* pointing towards the forward perpendicular. The cargo is represented by a concentrated force of 1800 tons at amidships, while the aft superstructure and machinery is represented by another concentrated force of 300 tons applied at 20 m from amidships. The ship is navigating in sea water with no presence of waves, and you are required to calculate the shear force at a point *x=+L/4*; express your answer in tons using sign convention from DNV. Consider *L*: 80 m, *B*: 13 m, and, *D*: 6.5 m.

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