College of Maritime Engineering and Sea Sciences

Ship's Structure

Second Quiz **July 16th, 2020**

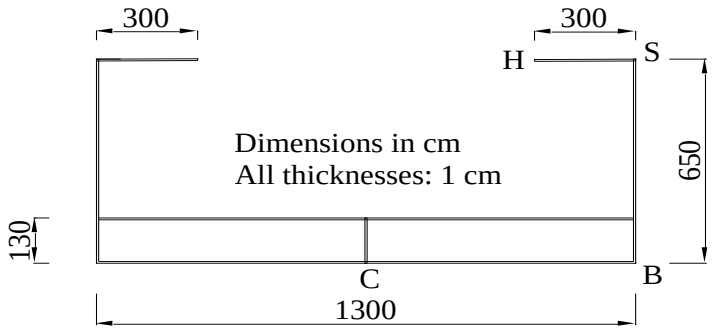
Open books

1. Using 2015 DNV rules for ships with length less than 100 metres, calculate the maximum pressure on the bottom area in the midship section region of a tanker ship, p1, which has the following main dimensions: L: 115m, B: 17.2m, D: 8.9m, T: 6.7m, V: 14.0 knots, and, Δ: 10285tons. Express your answer in height of sea water, *h*, in meters. (15)

2.a.- Applying Prof. Schade's method, the effectiveness of the deck plate of a river barge is estimated as 72%. The barge section is shown in the attached figure and has the following main dimensions: L: 80m, B: 13m, D: 6.5m, T_{loaded}: 4.5m and C_B:0.82, and, operates at a velocity of 12 knots; all plates have a thickness of 1 cm. Identify the point where the normal stress is maximum: C B S H (10)

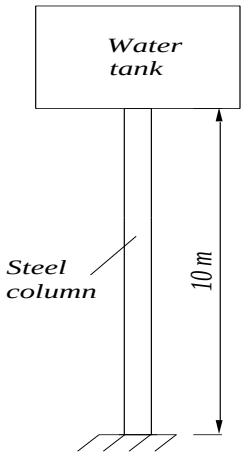
2.b.- In the river barge of problem 2a, calculate the minimum section modulus, in cm3. (20)

2.c.- On the midship section area of the river barge of problem 2a, the following load parameters were calculated: S.Force: 8500kN and B.Moment: 75000kN*m. Calculate the **maximum normal stress** on the section, in N/mm^2. (15)



3.a.- You are asked to design the column that supports a water reservoir for a small city. To analyze the possibility of buckling of the column using the conservation of energy, choose from the following **functions an adequate** to analyze this case. (10)

$$c_1\left(x\sin\frac{\pi x}{L}\right) \quad c_1\left(\cos\frac{2\pi x}{L}-1\right) \quad c_1\,(x-L)^2\,x^2 \quad c_1\,x^2$$



3.b.- Apply conservation of energy to deduce an expression for the critical buckling load using the approximating function previously selected in 3a, (15):

$$1:\ Pcr=\frac{4\pi^2 EI_c}{L^2} \quad 2:\ Pcr=\frac{\pi^2 EI_c}{2L^2} \quad 3:\ Pcr=\frac{3EI_c}{L^2} \quad 4:\ Pcr=\frac{3.1416EI_c}{L^2}$$

3.c.- If the water tank of problem 3a weighs 1ton, estimate the minimum value of the sectional inertia that the steel column must have; for the critical stress of a clamped column, use the following exact expression taken from Popov-s book: $\sigma_{cr}=\left(\pi^2 E\right)/\left(4\left(L/k_{zz}\right)^2\right)$. In the previous expression, k_{zz} is the gyration radius of the beam section. Express your answer in cm4. (15)