

College of Maritime Engineering and Sea Sciences

Ship's Structure

Second Quiz

July 16th, 2020

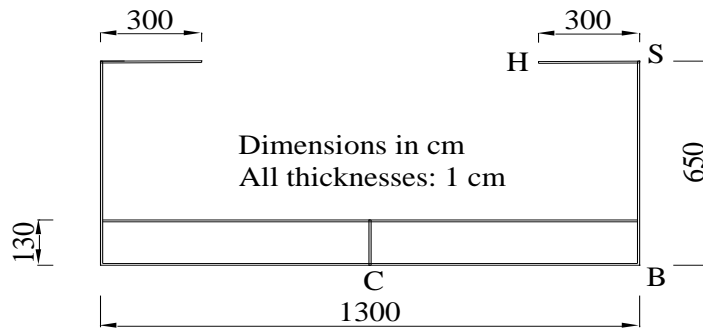
Open books

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/mm². (15)

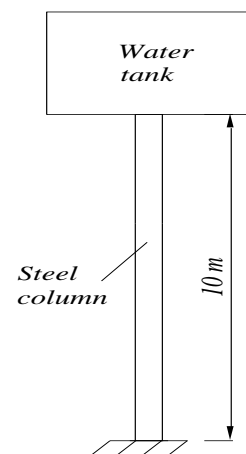


3.a.- You are asked to design the column that supports a water reservoir for a small city. To analyze the possibility of buckling of the column using the conservation of energy, choose from the following **functions an adequate** to analyze this case. (10)

$$c_1 \left(x \sin \frac{\pi x}{L} \right) \quad c_2 \left(\cos \frac{2\pi x}{L} - 1 \right) \quad c_3 (x-L)^2 \quad c_4 x^2 \quad c_5 x^2$$

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

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



3.c.- If the water tank of problem 3a weighs 1 ton, 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: $\sigma_{cr} = (\pi^2 E) / (4(L/k_{zz})^2)$. In the previous expression, k_{zz} is the gyration radius of the beam section. Express your answer in cm⁴. (15)