Faculty of Maritime Engineering and Marine Sciences

Ship Structures II

Second evaluation **August 26th, 2019**

Student: ....

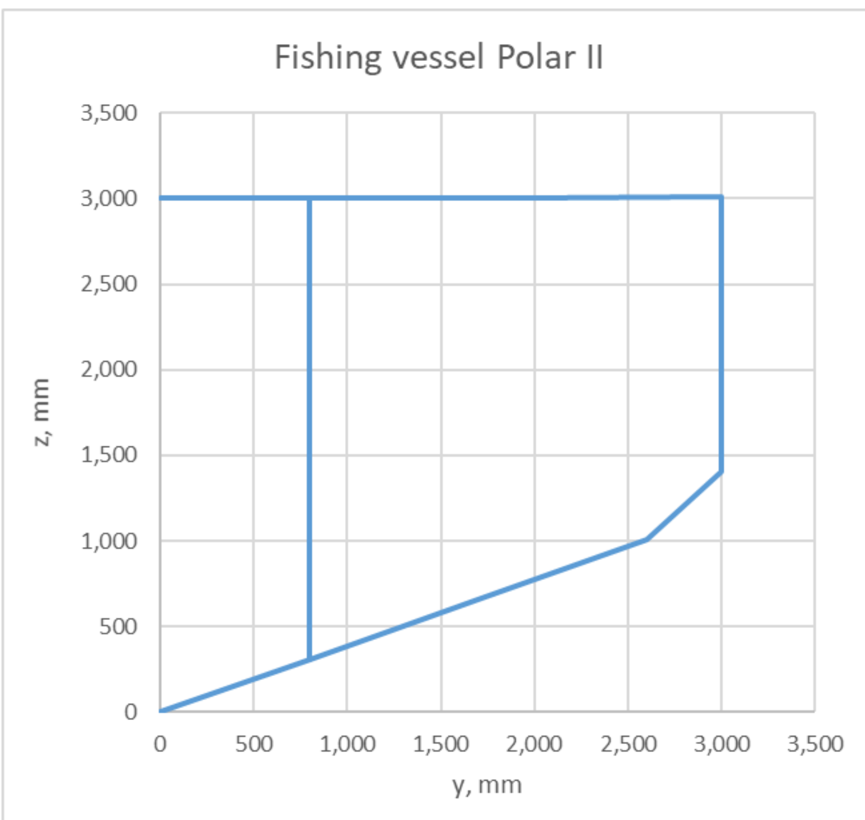
1.- In the DNV for ships with L>100m 2016 rules, section 5 "Longitudinal strength", part B "Still water and wave induce bending moment…", formulations to estimate bending moments are presented. Which of the following expressions is true? (5)

a.- In Hogging: $M_{WO} = -0.19\alpha C_W L^2 B C_B$	b.- In Sagging: $M_{WO} = 0.11\alpha C_W L^2 B(C_B + 0.7)$	c.- In Sagging: $M_{WO} = -0.11\alpha C_W L^2 B(C_B + 0.7)$
d.- None		

2.- To evaluate the possibility of buckling of deck plate, the following situation must be considered: (5)

a.- Hogging	b.- Still water	c.- Sagging	d.- All of them

3.- Present a sketch of the shear stress distribution in the following hull section of a small containership (do not think that I am going to give you these points away!): (10)



4.- The following equation is taken from DNV rules section 6 "Bottom structures", part C "Plating and stiffeners", to calculate the required thickness of bottom plating: (5)

302 The thickness requirement corresponding to lateral pressure is given by:

$$t = \frac{15.8 k_a s \sqrt{p}}{\sqrt{\sigma}} + t_k \quad \text{(mm)}$$

Which one of the following expressions is true?

a.- In longitudinal framing σ is larger	b.- In transverse framing σ is larger	c.- Independent of framing system.	d.- None of the above

5.- What is the maximum buckling critical stress that a steel plate can have? (5)

a.- $f = 1.88E6\left(\frac{t}{b}\right)^2 K, kg/cm^2$	b.- 235 N/mm^2	c.- 110 N/mm^2	d.- None of the above

6.- Why the Mª Carmen III tanker ship has a transverse framing system in the aft region? (10)

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7.- Explain two advantages of the longitudinal framing system for a ship, when it is compared with the transversely. (5)

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1.- Consider a steel ship, with the following main characteristic: *L* x *B* x *D*: 72 x 12 x 6 m, Δ =2250 tons, and it has estimated that in Sagging supports a bending moment of 75000 kN-m. At present sectional inertia (considering plating as well as longitudinal stiffeners) is 2.14E4 m^2-cm^2, with the deck plate with a thickness of 7 mm (A_{sect}: 0.336 m^2, and, y_{med}: 2.79 m, from base line). What would be the normal stresses in bottom and deck when the thickness of deck plate is changed to 8 mm? (25)

2.- Consider a reinforced rectangular steel plate panel (6.0x3.0m) that is going to support a uniform load of 50 kN/m^2. Assume that all edges are clamped, and make reasonable assumptions for other variables. Select in a preliminary stage of design the plate characteristic, and, stiffener spacing and scantlings. (30)

Useful formulations: *Bending of isotropic rectangular plates*, (Timoshenko):

$$\sigma_x = \frac{12\, z\, M_x}{t^3}$$

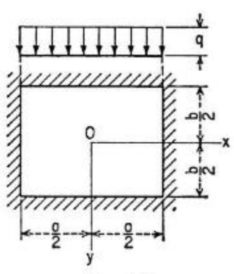

TABLE 35. DEFLECTIONS AND BENDING MOMENTS IN A UNIFORMLY LOADED RECTANGULAR PLATE WITH BUILT-IN EDGES (FIG. 91)
$\nu = 0.3$

b/a	$(w)_{x=0,y=0}$	$(M_x)_{x=a/2,y=0}$	$(M_y)_{x=0,y=b/2}$	$(M_x)_{x=0,y=0}$	$(M_y)_{x=0,y=0}$
1.0	$0.00126qa^4/D$	$-0.0513qa^2$	$-0.0513qa^2$	$0.0231qa^2$	$0.0231qa^2$
1.1	$0.00150qa^4/D$	$-0.0581qa^2$	$-0.0538qa^2$	$0.0264qa^2$	$0.0231qa^2$
1.2	$0.00172qa^4/D$	$-0.0639qa^2$	$-0.0554qa^2$	$0.0299qa^2$	$0.0228qa^2$
1.3	$0.00191qa^4/D$	$-0.0687qa^2$	$-0.0563qa^2$	$0.0327qa^2$	$0.0222qa^2$
1.4	$0.00207qa^4/D$	$-0.0726qa^2$	$-0.0568qa^2$	$0.0349qa^2$	$0.0212qa^2$
1.5	$0.00220qa^4/D$	$-0.0757qa^2$	$-0.0570qa^2$	$0.0368qa^2$	$0.0203qa^2$
1.6	$0.00230qa^4/D$	$-0.0780qa^2$	$-0.0571qa^2$	$0.0381qa^2$	$0.0193qa^2$
1.7	$0.00238qa^4/D$	$-0.0799qa^2$	$-0.0571qa^2$	$0.0392qa^2$	$0.0182qa^2$
1.8	$0.00245qa^4/D$	$-0.0812qa^2$	$-0.0571qa^2$	$0.0401qa^2$	$0.0174qa^2$
1.9	$0.00249qa^4/D$	$-0.0822qa^2$	$-0.0571qa^2$	$0.0407qa^2$	$0.0165qa^2$
2.0	$0.00254qa^4/D$	$-0.0829qa^2$	$-0.0571qa^2$	$0.0412qa^2$	$0.0158qa^2$
∞	$0.00260qa^4/D$	$-0.0833qa^2$	$-0.0571qa^2$	$0.0417qa^2$	$0.0125qa^2$

Equivalent von Mises stress: $\sigma_{eq} = \sqrt{\sigma_1^2 - \sigma_1 \sigma_2 + \sigma_2^2}$.

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jrml/2019