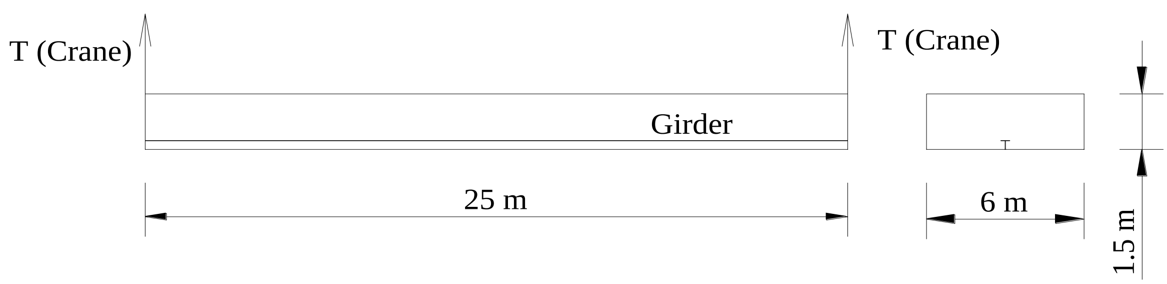
College of Maritime Engineering, and Biological, Oceanical and Natural Resource Sciences

Ship Structures II

Second evaluation **August 29, 2016**

Student: ....

1.- Primary bending of a box barge with the following dimensions is to be analyzed: L: 25 m, B: 6 m, and D: 1.5 m, when the vessel is suspended from its ends by a crane. Hull structure includes a longitudinal girder welded to the bottom plate. Machinery and miscellaneous weight 15 tons. Calculate hull maximum deflection, assuming weight distribution is uniform. (30)



Bottom plate: 5 mm
Side plate: 4 mm
Transverse frame spacing: 50 cm

Long.Girder: I_c: 1000cm^4, A: 24cm^2, d_m: 15cm (from bottom)
Deck plate: 4 mm
Transverse frames: L60x60x5 mm

2.- If the framing system of ship in problem 1 is transversal, with deck frames (L60x60x5 mm) separated 50 cm, is it possible that deck plates may buckle in the above described situation? (20)

3.- The structure of a ship, L: 80 m, B: 12 m, D: 6 m and T: 4 m is to be designed. It has transverse framing and simple botton, with a distribution that includes 2 longitudinal bulkheads and 6.0 m of separation between transverse bulkheads. Any other assumption is to be explained.

a.- Rationally select spacing for primary and secondary stiffeners, and prepare a scheme of the primary structure. (10)

b.- Calculate thickness for bottom plating with a 120 N/mm^2 allowable stress. Use the following formulation to estimate pressure: $10T+0.12L$, KN/m^2. (10)

c.- According to DNV secondary stiffeners may support a 160 N/mm^2 normal stress, what dimensions (scantlings) would you recommend for them? (15)

d.- Evaluate the possibility of failure of the *bottom plate* considering a combination of stresses. Clearly show the point of analysis. Use a *-100 N/mm^2* value for the primary normal stress. Equivalent von Mises stress is: $\sigma_{eq} = \sqrt{\sigma_x^{\,2} + \sigma_y^{\,2} - \sigma_x \sigma_y + 3\tau^2}$. (15)

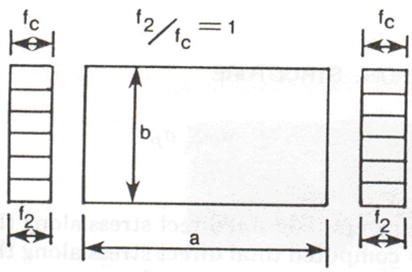
Buckling critical stress for plates in compression (DNV): $f_{crc}=f_t$.

$$f_t = f_e, \quad f_e/f_y \le 0.75, \qquad f_t = f_y\left(1-\frac{3\,f_y}{16\,f_e}\right), \quad fe/fy > 0.75,$$

where the reference stress is: $f_e = 1.88E6\left(\frac{t}{b}\right)^2 K, \quad kg/cm^2$, t and b in mm

(A) For plate panels between stiffeners;

Type of Loading	Description	K
1. For evaluating f_{crc}:		corresponding to axial compression and bending



where $a/b \geqq 1.0$ - - - - - - - 4

where $a/b < 1.0$ - - - - - - - $\left(\frac{a}{b}+\frac{b}{a}\right)^2$

Bending of isotropic rectangular plates, (Timoshenko):

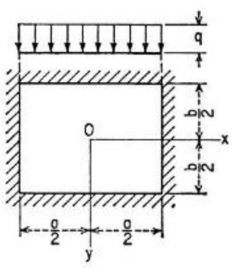


TABLE 35. DEFLECTIONS AND BENDING MOMENTS IN A UNIFORMLY LOADED RECTANGULAR PLATE WITH BUILT-IN EDGES (FIG. 91)

$\nu = 0.3$

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	$0.00254qa^4/D$	$-0.0829qa^2$	$-0.0571qa^2$	$0.0412qa^2$	$0.0158qa^2$
∞	$0.00260qa^4/D$	$-0.0833qa^2$	$-0.0571qa^2$	$0.0417qa^2$	$0.0125qa^2$

I certify that during this exam I have complied with the Code of Ethics of our university.

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