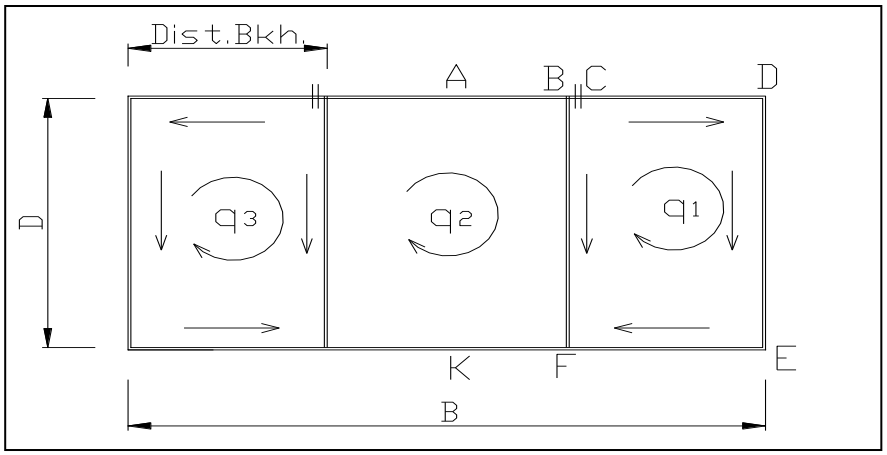
College of Maritime Engineering, and Biological, Oceanical and NN.RR. Sciences

Ship Structures I

1st Evaluation, II 2017 November/30/2017

Student: ……

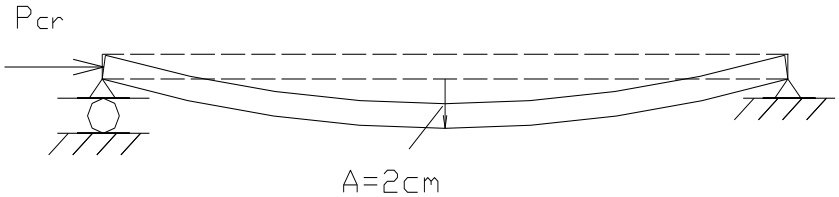
1.- The following is a simplified section of a steel tanker ship, which includes simple bottom and two longitudinal bulkheads, with dimensions: *B*=9.3, *D*=4.65, and *DBkh*=3.2 in meters. All thicknesses are 8 mm.



In a preliminary analysis, after performing two cuts in the section, values for the correcting shear flows are q'_1: -81.3, q'_2: 0.0 and q'_3: +81.3 m^2-mm ($q'_i = Ic\ q_i/V$, where *Ic* is the sectional inertia, q_i is the correction shear flow and *V* is the shear force on the section).

Determine the maximum shear force that may be applied on the structure, with a safety factor of 1.2. (35)

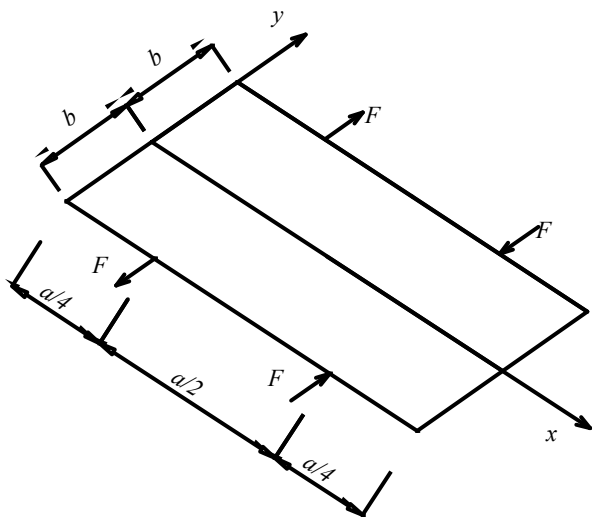
2.- Energy methods: Consider the elastic buckling of a flat bar (*l*: 50 cm and, rectangular constant transverse section 2.5x0.3 cm) made of aluminum alloy (*E*: 7.0E5 kg/cm^2, ν: 0.33, and, σ_y: 210 N/mm^2). In an experimental apparatus, it is measured the amplitude of lateral deflection after the column has buckled, 2 cm, as shown in the figure. Calculate the work developed by the axial force from the beginning of the experiment until the column reaches its equilibrium after buckling. (30)



3.- Plane stress: Four concentrated forces are applied on a isotropic rectangular flat plate of 8 mm in thickness, on its *x*-edges, as shown in the following figure. Each force *F* is 500 kN, and plate dimensions are: a= 2.5 m, and $2b$= 1.0 m.

a) You are asked to express the load distribution with two harmonics of the sinusoidal series, so calculate their amplitudes q_1 and q_2, and comment on your results. (10)

b) Calculate how much changes the dimension in the *x* direction of the plate, at the horizontal centerline, that is estimate *u(x, y=0)* with respect to the displacement of the origin. Plot and comment your results. (15)



4.- Give translation of the following technical terms: (10)

Momento Flector ……... Espesor ……..……..

Mamparo Estanco ……....…… Deformación Unitaria ……..

Pandeo …… Empotrado ……..……

Ala …….. Alma ……..

From class notes: $C_1 = \frac{2A}{\alpha^2}\ \frac{senh\alpha b + \alpha b \cosh \alpha b}{senh\, 2\alpha b + 2\alpha b}$, $\quad C_4 = -\frac{2A}{\alpha^2}\ \frac{\alpha senh\, \alpha b}{senh\, 2\alpha b + 2\alpha b}$.

$$\sigma_x(x,y) = \sum_{m=1}^{\infty} 2q_m sen\, \alpha_m x \left[\frac{(\alpha_m b \cosh \alpha_m b - senh\, \alpha_m b)\cosh \alpha_m y - \alpha_m y\, senh\, \alpha_m b\, senh\, \alpha_m y}{senh\, 2\alpha_m b + 2\alpha_m b} \right]$$

$$\sigma_y(x,y) = \sum_{m=1}^{\infty} -2q_m sen\, \alpha_m x \left[\frac{(\alpha_m b \cosh \alpha_m b + senh\, \alpha_m b)\cosh \alpha_m y - \alpha_m y\, senh\, \alpha_m b\, senh\, \alpha_m y}{senh\, 2\alpha_m b + 2\alpha_m b} \right]$$

$$\tau_{xy}(x,y) = \sum_{m=1}^{\infty} -2q_m \cos \alpha_m x \left[\frac{\alpha_m b \cosh \alpha_m b\, senh\, \alpha_m y - \alpha_m y\, senh\, \alpha_m b \cosh \alpha_m y}{senh\, 2\alpha_m b + 2\alpha_m b} \right]$$

jrml/2017

I declare that during this exam I have fulfilled the Code of Ethics of our university.

……