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

**First Evaluation – Ship Vibrations** **June 29th, 2018**

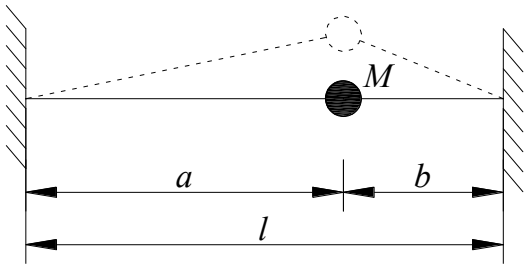
Student: .....

**1.-** Calculate the time to reach the first maximum value of the acceleration resulting from the following function for the displacement of a ship. Frequency of oscillation is 2 Hz.

$$w(t) = 2\cos\omega t - 3i\,e^{i\omega t} - 4sen(\omega t - 30^o) + \overline{C}e^{i\omega t},$$

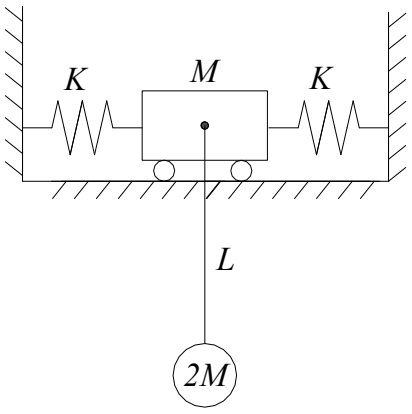
where: $\overline{C} = 4 + 5i$. (15)

**2.-** A mass *M* is attached to a cord that is under a tension *T*, as shown in the attached figure. Assuming that *T* remains unchanged when the mass is displaced normal to the cord, (a) deduce the differential equation of motion for small transverse vibrations and (b) find the natural frequency of vibration. (20)




**3.-** A 5 hp centrifugal water pump, weighing 600 N and operating at 1000 rpm, is mounted on six springs of stiffness 6000 N/m each. Find: the maximum permissible unbalance in order to limit the steady-state deflection to 5 mm peak-to-peak, and, with that amount of unbalance, the force transmitted to the foundation. (30)

**4.-** You have to analyze the following system composed of a block of mass *M* which moves on wheels with no friction, and with two installed springs of stiffness *K* on each side. The block has a simple pendulum of length *L* and mass *2M*, connected to it. Establish the equations of motion of the system, and, deduce expressions for its natural frequencies of oscillation. (35)

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

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