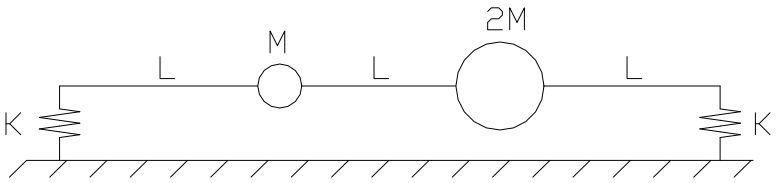
**College of Maritime Engineering and Sea Sciences**

**Ship Dynamics**

**First evaluation** **Dic. 06, 2016**

Student: .....

**1.-** Consider a simplified model to analyze ship motion oscillation in the vertical plane, consisting of a rigid bar with two concentrated masses, *M* and *2M*, as shown in the figure. The restoring action is represented by two springs, of equal stiffness, *K*.



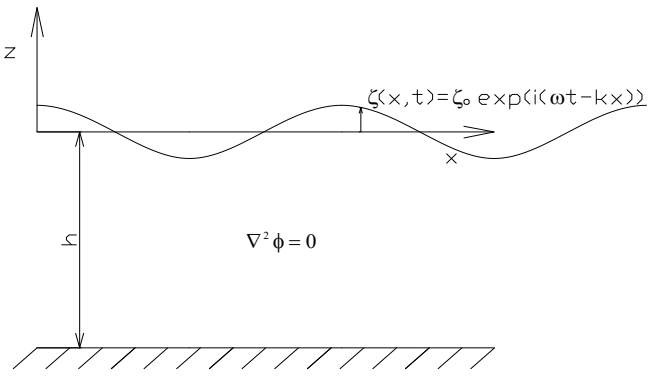

i.- Deduce equations of motion in the vertical plane, (10), and,

ii.- Calculate natural frequencies of the system, considering the following values: *M*= 7.0E5 kgm, and *K*= 1960 kN/m, (10), and,

iii- Plot the mode shapes. (10).

**2.-** Consider a wave train moving in shallow water (*h* is not very large). The following function will be used for the velocity potential, to analyze this problem, where *h* is the depth of water, as shown in the figure.

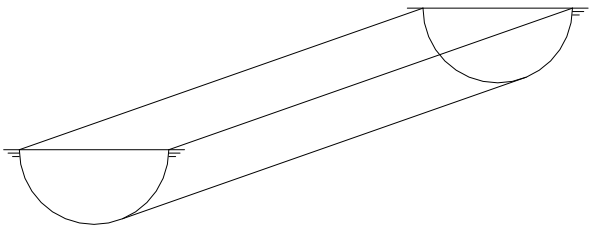
$$\phi = \frac{i\varsigma_o g}{\omega}\frac{\cosh k(z+h)}{\cosh kh}e^{i(\omega t - kx)}$$




i.- Check that the function is adequate to analyze the problem. (20)

ii.- Deduce an expression for the Dispersion relation for waves in shallow water. (15)

**3.-** The **pure pitch motion** of a simplified canoe is going to be analyzed. Main dimensions are: *L*= 8m, *B*: 1.5 m, and *T*: 0.75 m, and, its constant section has semicircular shape. Prepare a free bodydiagram and then make an estimation of its natural frequency for pitch, including hydrodynamic effects, considering that the mass is uniformly distributed. (35)



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Certifico que durante este examen he cumplido con el Código de Ética de nuestra universidad:

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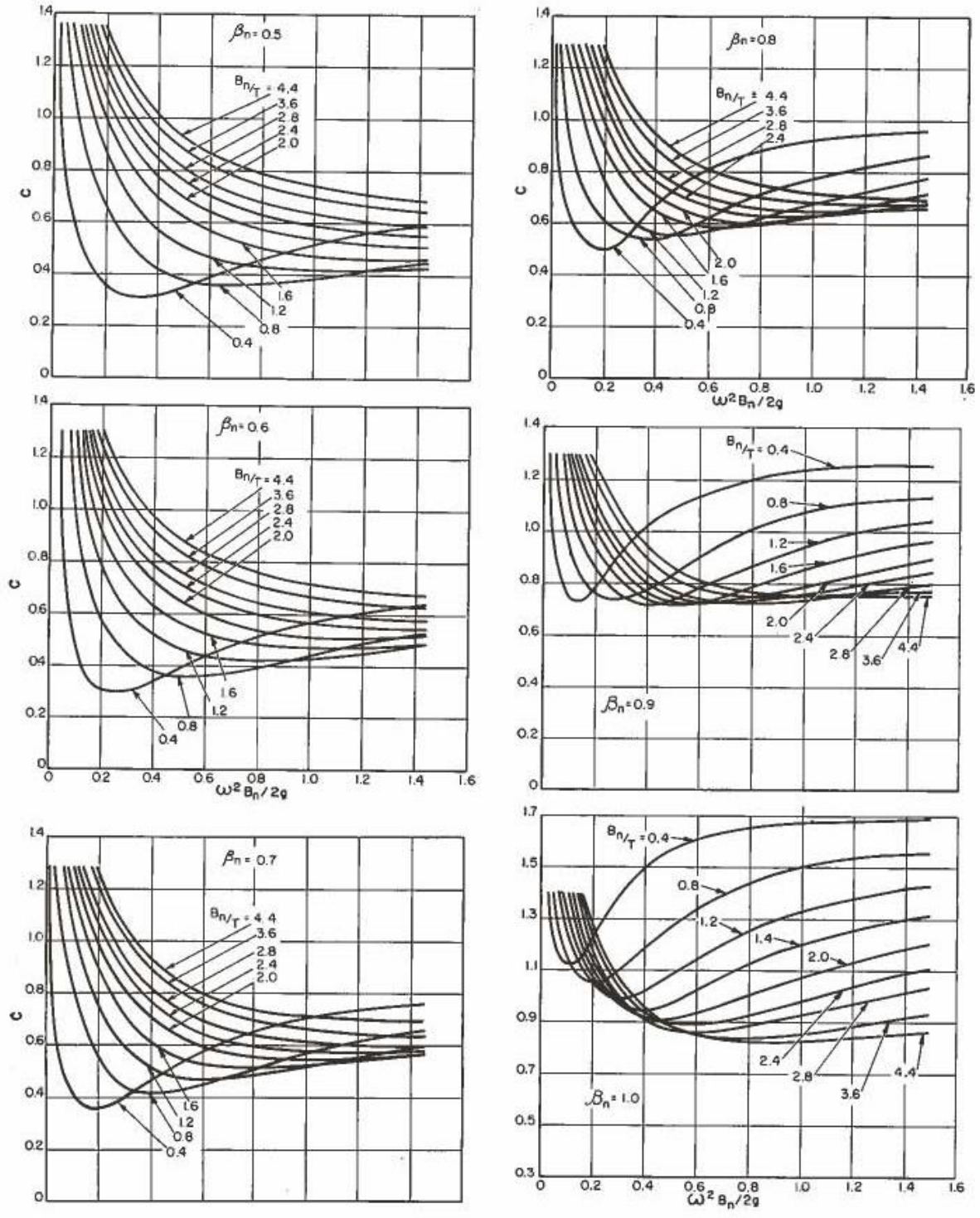


Fig. 37 Grim's (1959) computations of hydrodynamic mass coefficients C for two-dimensional floating bodies in heaving motion (Ref. [26])