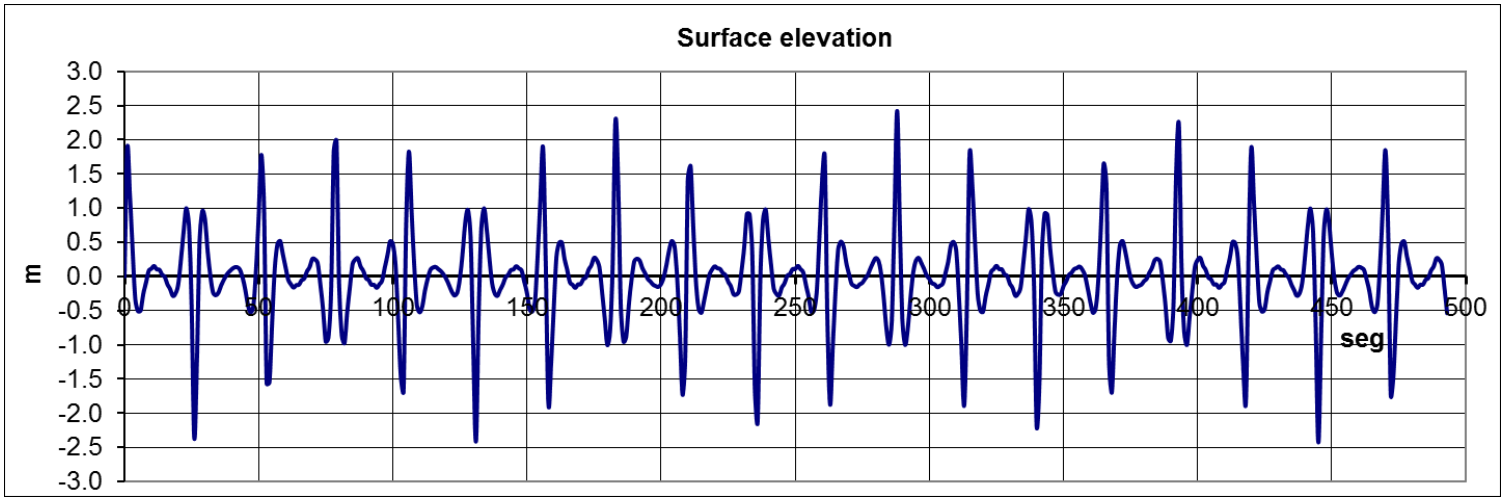
College of Maritime Engineering, and Biological, Oceanical and Natural Resource Sciences

Ship Structures II

First Evaluation **June 28th 2017**

Student: .....

1.- Estimate the significative height of the surface elevation for sea state 5 ("*Strong breeze"*), using the following record. (20)



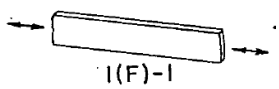
Rayleigh probability density function: $f(r) = \frac{r}{\sigma_R{}^2} e^{-1/2(r/\sigma_R)^2}$.

2.- Fatigue.- A structural element (flat bar) with transverse section of 5x1/2 inches supports half million cycles before breaking because of fatigue. If you want the bar to reach a life of 7.5E5 cycles, what would be the dimensions for the element? You have the following available information from a group of model tests [Munse], detail 1(F), and you may assume that at 10^7 cycles, it starts the horizontal part of the *S-N* curve. Please notice that the system of units is English.

Mean Stress Range for Fatigue Details in Fig. 2.

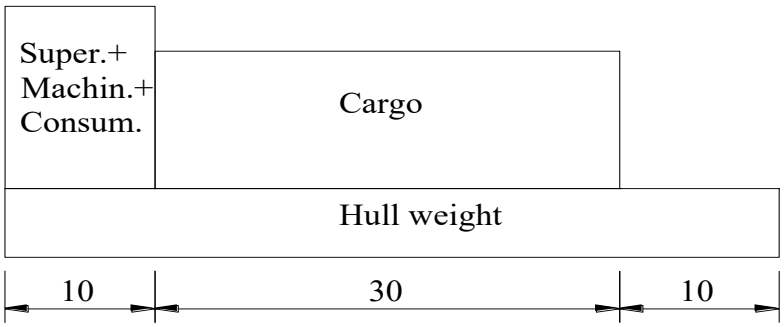
nstant Cycle - 0.50 Reliability)

Detail No.[1] (see Fig. 2)	Stress Range, ksi, for n cycles[2]			
	$n = 10^5$	$n = 10^6$	$n = 10^7$	$n = 10^8$
1	69.4	46.5	31.1	20.8
1(F)	67.1	41.5	25.7	15.9
2	61.5	42.0	28.7	19.62
3	44.1	29.6	19.9	13.33
				12.87



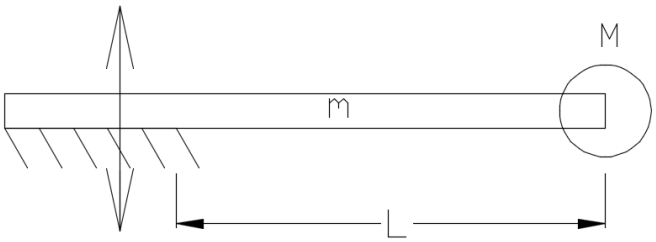
Fatigue S-N curve: $N = \frac{K_0}{S^m}$

3.- Hull beam loads.- Calculate and plot the shear force distribution which is developed in a box barge (*L*: 50, *B*: 10) in *Hogging condition* with an equivalent sinusoidal wave height of 1.5 m, in the load condition shown in the figure. Identify extreme values. (30)



Weights on the ship are: hull: 250 tons, cargo: 600 tons, and, superstructure, machinery and consumables: 100 tons in the aft part of the ship; all weights may be assumed as uniformly distributed.

4.- Inertial load.- Consider the oscillation of a beam connected to the shaker of the Naval engineering lab. The vertical base motion has an amplitude of 10 mm peak to peak, and frequency of oscillation 5 hz. The specimen is an aluminum alloy beam (ρ: 2600 kg/m^3, *E*: 6.89E10 N/m^2) flat bar type, *L*: 40 cm in length and sectional dimensions 4x0.4 cm, with a 0.5 kg$_m$ concentrated mass *M* on its end. Calculate the stress due to the dynamic load, at the clamped end of the beam, neglecting the dynamic deflection; use the sign convention for beam bending employed in Solid Mechanics I. (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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