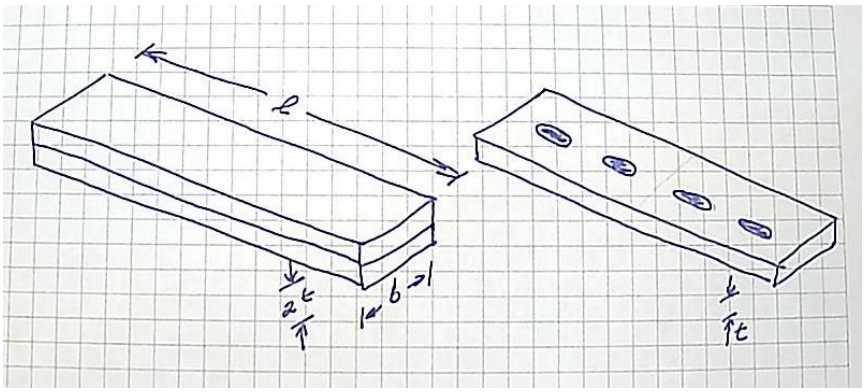
College of Maritime Engineering and Sea Sciences

Ship's Structure

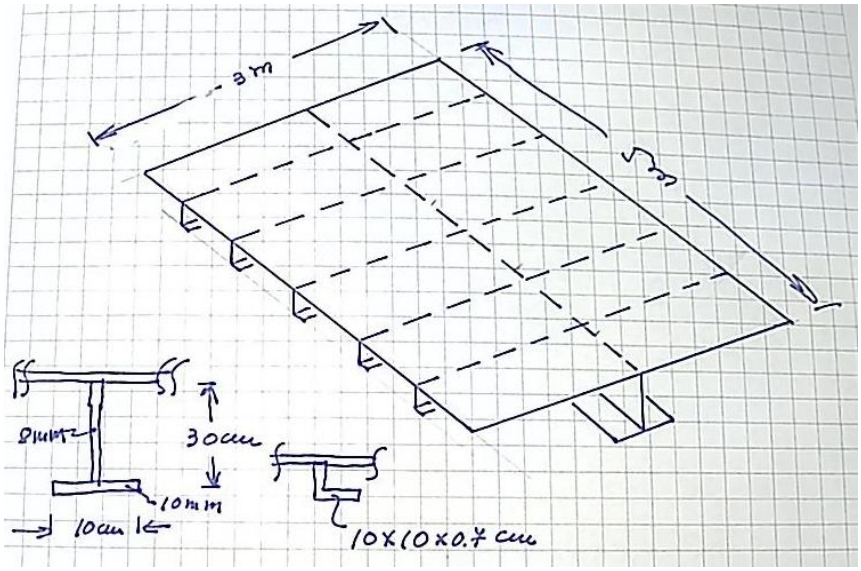
Second Quiz **July 6th, 2021**

Open books

1. Consider a clamped beam 30 cm in length, formed by two ice cream sticks which are glued together, each one of 2 cm width and 2 mm in thickness. Young modulus of wood is 1.1E9 N/m^2 and Poisson ratio is 0.35. A concentrated load of 20 Newtons is applied in the center point of its length, and after that the points with the glue break up in shear. What is the force that each glue point can sustain before breaking? (25)



2. Calculate the maximum normal stress in the direction of the girder on the deck plate in the central zone of the span, using DNV regulations which are attached. The plate is made of steel, 8 mm in thickness, and has one girder and several stiffeners welded to it. Pressure acting on the deck is 20 kN/m^2. The girder is formed by a T beam, and stiffeners are angles. All edges of the structure are to be considered as clamped. (40)



402 The effective plate flange area is defined as the cross-sectional area of plating within the effective flange width. Continuous stiffeners within the effective flange may be included. The effective flange width b_e is determined by the following formula:

$$b_e = C\,b$$

C = as given in Table C1

Table C1 Values of C

a/b	*0*	*1*	*2*	*3*	*4*	*5*	*6*	*≥7*
C (r ≥ 6)	0.00	0.38	0.67	0.84	0.93	0.97	0.99	1.00
C (r = 5)	0.00	0.33	0.58	0.73	0.84	0.89	0.92	0.93
C (r = 4)	0.00	0.27	0.49	0.63	0.74	0.81	0.85	0.87
C (r ≤ 3)	0.00	0.22	0.40	0.52	0.65	0.73	0.78	0.80

a = distance between points of zero bending moments, see Fig.9
= S for simply supported girders
= 0.6 S for girders fixed at both ends

S = span of girder

b = plate flange width taken as the sum of half spans of adjacent stiffeners, see Fig.8

r = number of stiffeners along girder span.

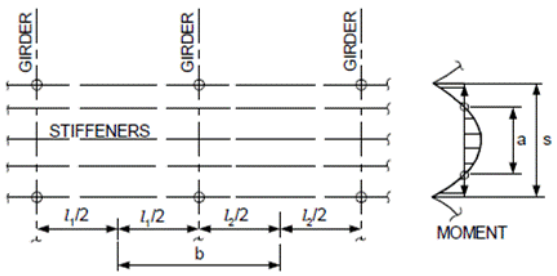
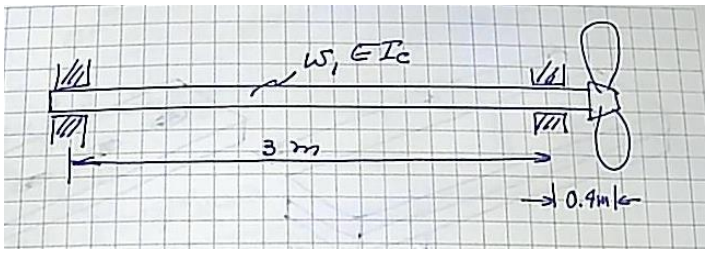


Fig. 9
Effective flange

3. Apply an energy method to approximate the deflection of the end point of a ship propulsion system which includes two simple supports. The steel shaft has uniform section with 10 cm in diameter and the propeller is 4 bladed, built with bronze and has a weight of 2500 Newtons. Weight of the shaft must be included, with specific weight of 76 KN/m^3. (35)



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