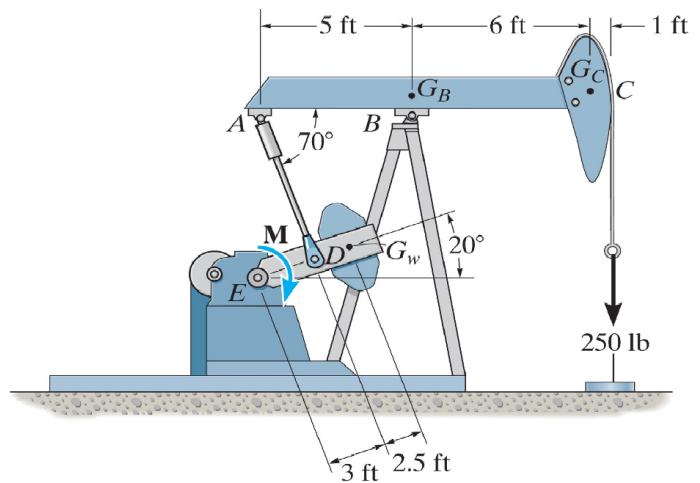


Name: _____

Group members: _____

TAM 210/211 - Worksheet 9

1) A pumping unit is used to recover oil. When the walking beam ABC is horizontal, the force acting in the wireline at the well head is 250 lb. The horse-head C weighs 60 lb and has a center of gravity at G_c . The walking beam ABC has a weight of 130 lb and a center of gravity at G_B , and the counterweight has a weight of 200 lb and a center of gravity at G_w . The pitman, AD , is pin connected at its end and has negligible weight (a two-force member). Determine the torque M which must be exerted by the motor in order to overcome the force at the well head through the following steps.



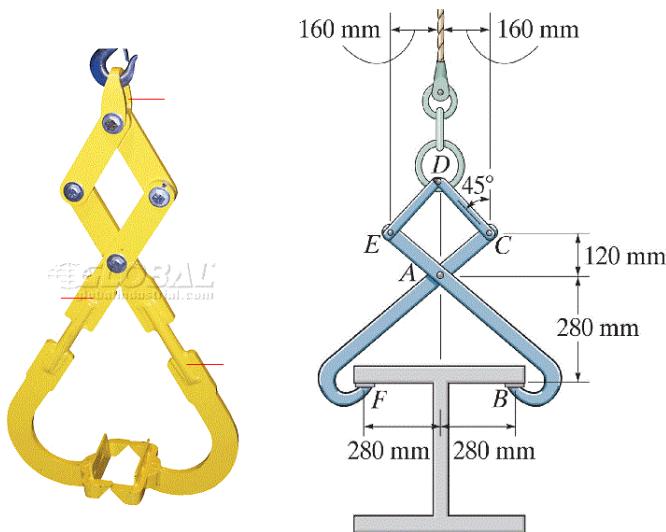
a) Draw a free-body diagram for the walking beam ABC

b) Use equilibrium equations to find the force from link AD .

c) Draw a free-body diagram for the member ED

d) Use equilibrium equations to determine the torque M which must be exerted by the motor in to keep member ED at equilibrium. This is also the torque necessary to overcome the force at the well head.

2) The double link grip is used to lift a beam that weighs 4kN. The interactions between the grip and the beam at points F and B are not smooth surfaces, so horizontal forces from friction are present. Determine the magnitude of these friction (horizontal) forces at B and F necessary to keep the I-beam at equilibrium.



a) Draw a free-body diagram for ring D (use particle assumption). Then write the equations of equilibrium to find the force from link CD .

b) Draw the free-body diagram for the I-beam. Use the equilibrium equation $(\sum M)_F = 0$ and $\sum F_y = 0$ to determine the vertical reactions that the flange of the beam exerts on the jaw at F and B .

c) Draw the free-body diagram for member CAF . Then use equilibrium equations to determine the friction forces at B and F .