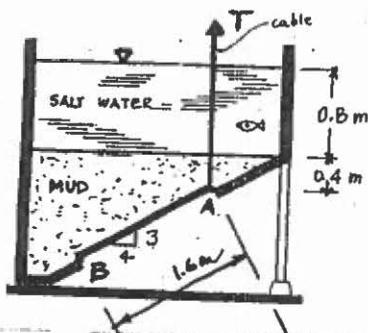
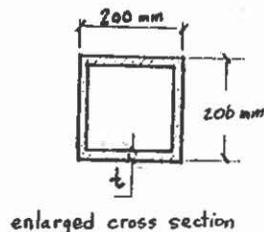
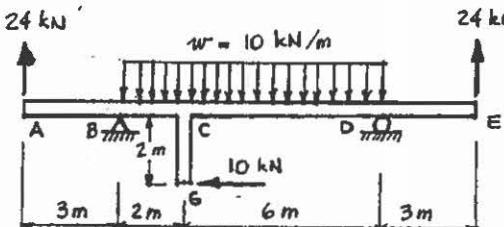


CIV100 MECHANICS - FINAL EXAM 2010

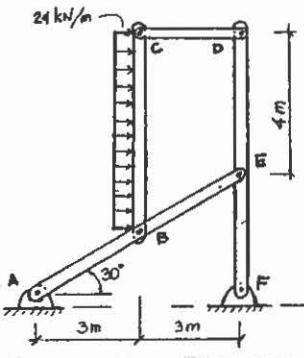
1. The cross section of a tank with an inclined bottom is shown below. The tank is filled with mud and water as shown. In this inclined bottom there is a uniformly thick gate ($1.6 \text{ m} \times 2.2 \text{ m}$) which is hinged at B and rests at the bottom of the tank at A. The gate which has a weight of 12 kN can be opened by means of the cable at A. The density of the salt-water is 1040 kg/m^3 and of mud is 1760 kg/m^3 . Determine the tension in the cable just as the gate opens. Show all forces on a separate free body diagram.



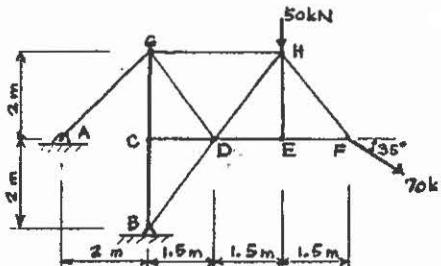
3. The beam shown below is supported by a pin at B and roller at D. For the given loading determine:
 a) In the space provided draw the bending moment and shear force diagrams for the horizontal part of the beam.
 b) If the cross section is a hollow square as shown in the figure determine the minimum wall thickness (t) if the material is steel with the yield stress of 400 MPa in both tension and compression and with the load/safety factor of 1.6.



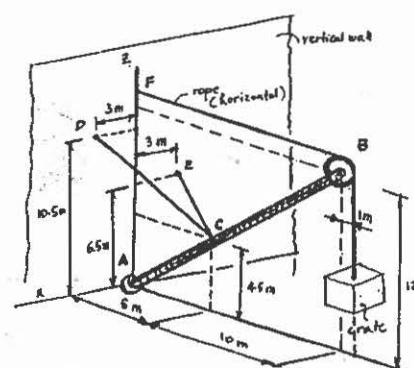
2. Given below is a pin connected and pin supported frame with loading as shown. Determine the reaction components at supports A and F and all force components acting on member ABE. Show your answers on a separate diagram of ABE.



4. The steel truss shown is supported by a pin at A and a pin at B. The yield stress for the steel is 380 MPa , and the load/safety factor is 1.9.
 a) determine the forces in members GH, DH and BC and indicate if in tension (T) or compression (C).
 b) determine the required cross section for members GH and BC assuming that they have to have the same cross-section. All cross-sections are square steel bars and the sides are available in increments of 5 mm.

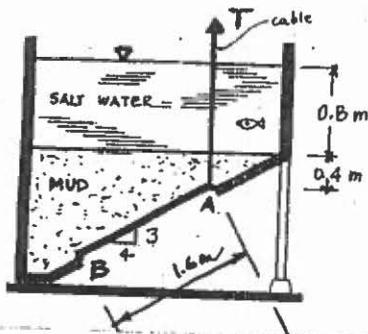


5. The 20 m long straight, light boom AB is supported by ball and a socket joint at A and by two cables CD and CE. A 2 m diameter frictionless pulley is pinned to the boom at B and supports 5100 N crate. The boom is in the y-z plane and points D, E and F are in a vertical wall coinciding with the x-z plane ($y = 0$). The pulley and rope combination lie in the vertical y-z plane. Neglecting the weight of the boom determine the magnitude of tension in cable CD and CE.



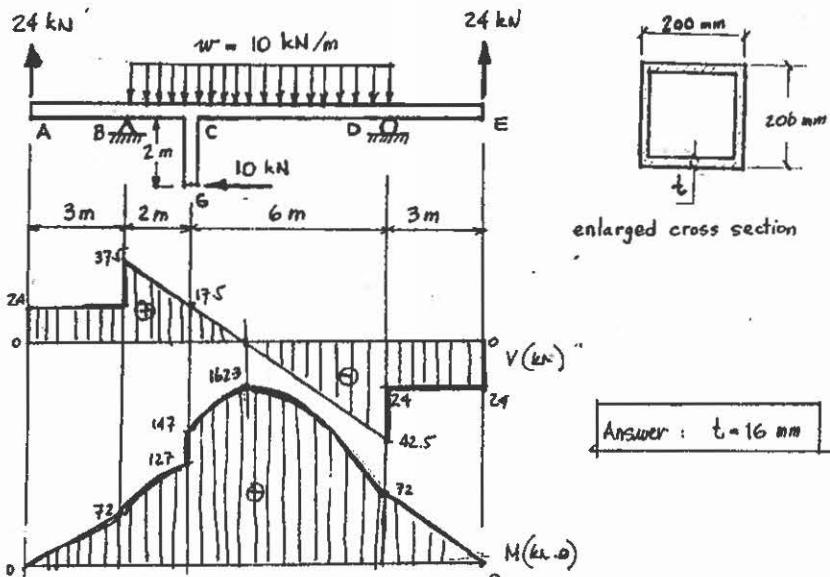
CIV100 MECHANICS - FINAL EXAM 2010

1. The cross section of a tank with an inclined bottom is shown below. The tank is filled with mud and water as shown. In this inclined bottom there is a uniformly thick gate ($1.6 \text{ m} \times 2.2 \text{ m}$) which is hinged at B and rests at the bottom of the tank at A. The gate which has a weight of 12 kN can be opened by means of the cable at A. The density of the salt-water is 1040 kg/m^3 and of mud is 1760 kg/m^3 . Determine the tension in the cable just as the gate opens. Show all forces on a separate free body diagram.



Answer: $T = 51.5 \text{ kN}$ (T)

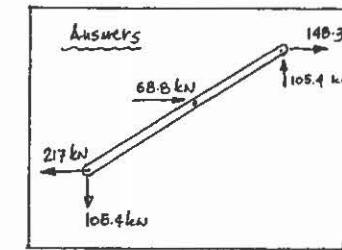
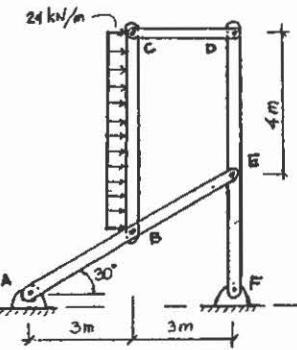
3. The beam shown below is supported by a pin at B and roller at D. For the given loading determine:
 a) In the space provided draw the bending moment and shear force diagrams for the horizontal part of the beam.
 b) If the cross section is a hollow square as shown in the figure determine the minimum wall thickness (t) if the material is steel with the yield stress of 400 MPa in both tension and compression and with the load/safety factor of 1.6.



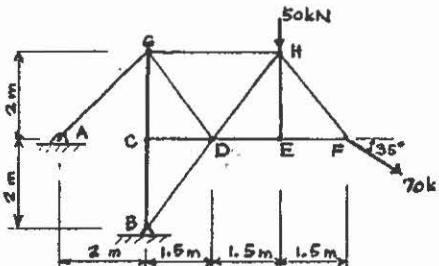
enlarged cross section

Answer: $t = 16 \text{ mm}$

2. Given below is a pin connected and pin supported frame with loading as shown. Determine the reaction components at supports A and F and all force components acting on member ABE. Show your answers on a separate diagram of ABE.



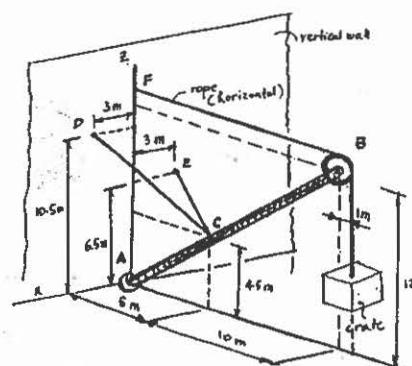
4. The steel truss shown is supported by a pin at A and a pin at B. The yield stress for the steel is 380 MPa , and the load/safety factor is 1.9.
 a) determine the forces in members GH, DH and BC and indicate if in tension (T) or compression (C).
 b) determine the required cross section for members GH and BC assuming that they have to have the same cross-section. All cross-sections are square steel bars and the sides are available in increments of 5 mm.



Answers: $GH = 97.7 \text{ kN}$ (T)
 $DH = 112.7 \text{ kN}$ (C)
 $BC = 129.5 \text{ kN}$ (T)

Cross section for BC & BD:
 $30 \times 30 \text{ mm}$

5. The 20 m long straight, light boom AB is supported by ball and a socket joint at A and by two cables CD and CE. A 2 m diameter frictionless pulley is pinned to the boom at B and supports 5100 N crate. The boom is in the y-z plane and points D, E and F are in a vertical wall coinciding with the x-z plane ($y = 0$). The pulley and rope combination lie in the vertical y-z plane. Neglecting the weight of the boom determine the magnitude of tension in cable CD and CE.



Answers:
 $T_{CD} = 1800 \text{ N}$ (T)
 $T_{CE} = 1400 \text{ N}$ (T)