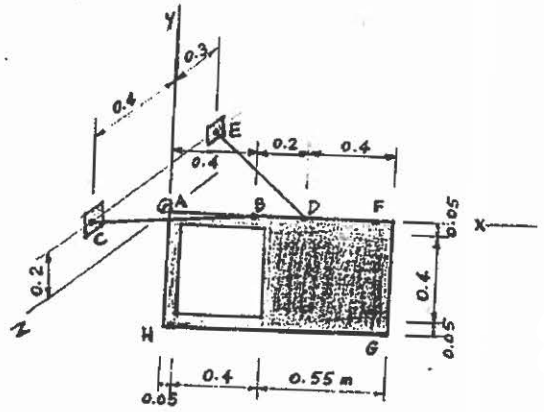
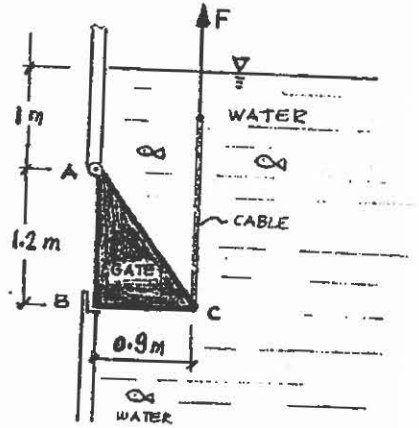
CIV100 MECHANICS- FINAL EXAM 2011

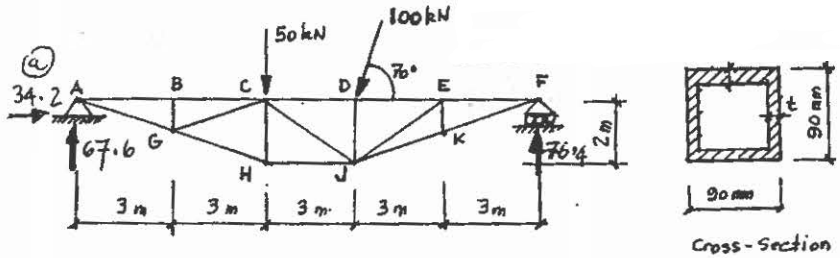
1. The given vertical sign **ABDFGH** is homogeneous, has a uniform thickness, and weighs 340 N. There is a square hole (0.4 x 0.4) in the sign as shown. The sign is supported by a ball and a socket at **A** and by two cables **BC** and **DE**. Determine the forces in the two cables and the reaction components at **A**.
All given dimensions are in metres.



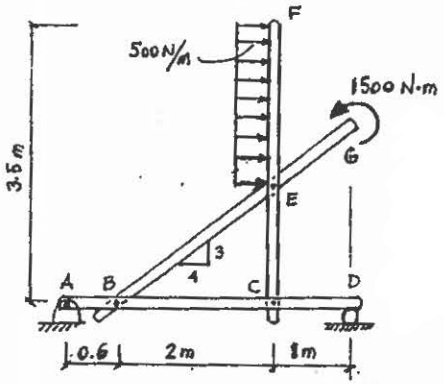
2. ABC shown below is the cross-section of a **solid gate**, 5 m wide (into the paper), within a fresh water channel. The homogeneous gate has a mass of 3000 kg, is pinned at **A**, and rests against a vertical wall at **B**, and can be opened by a cable at **C**. What force **F** is required, when the gate is just opening ? Use a new free body diagram.



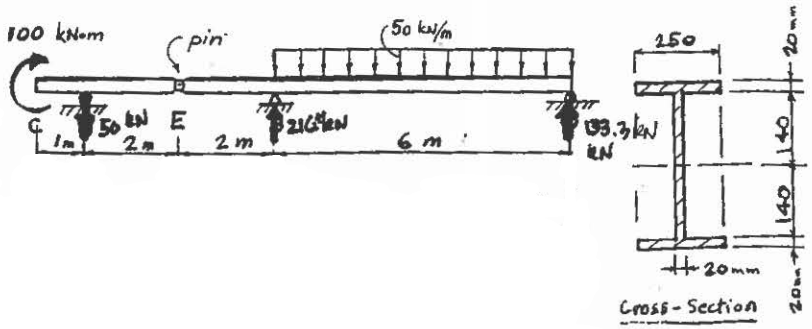
3. The steel truss below is supported by a pin at **A** and a roller at **F**. For the given truss determine:
   a. Reaction components at **A** and **F**.
   b. The forces in members **GH** and **GC**.
   c. For a different loading, member **GH**, which has a hollow cross-section as shown, is subjected to a tension force of **150 kN**. The material has a yield stress of **360 MPa** and a load factor is **1.8**. Determine the wall thickness (t) of the cross section.
   d. Based on your results, determine the elongation of **GH**, if the modulus of elasticity (E) is **200 000 MPa**.



4. The pin-connected frame is supported by a pin at **A** and a roller at **D**. Neglecting the weight of all members, determine all force components on member **ABCD**. Show your final answer on a **new free body diagram** sketch of **ABCD**.



5. The steel beam shown below has an internal pin at **E** and is supported by a roller at **A** and **D** and by a pin at **B**.
   a. Determine the reactions at **A**, **B** and **D**.
   b. Draw neatly the shear and moment diagrams in the spuce provided below the beam.
   c. If the yield stress for the material of the beam is **120 MPa** and the load factor is **1.8**, for the given cross-section below determine if this beam is safe.



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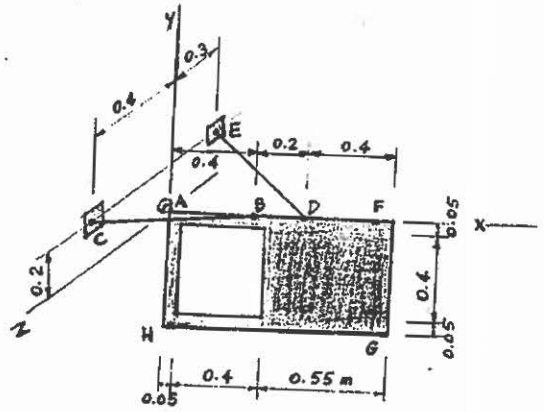

Answers:
$T_{CE} = 675\ N(T)$
$T_{ED} = 700\ N(T)$
$A_x = 108\ N \rightarrow$
$A_y = 85.3\ N \downarrow$
$A_z = 1521\ N \nearrow$

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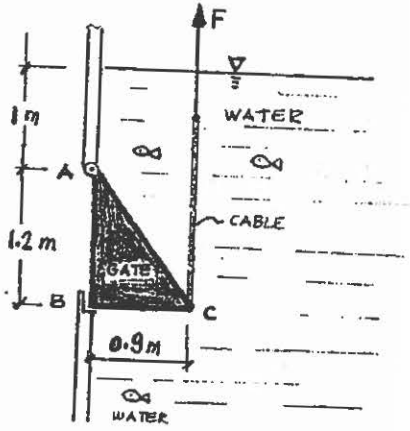

Answer : F=71.5 kN(T)

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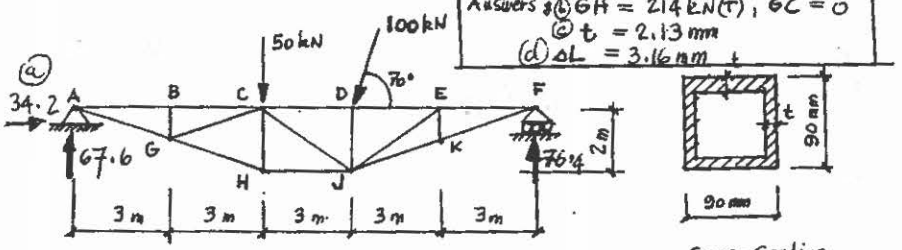
   d. Based on your results, determine the elongation of **GH**, if the modulus of elasticity (E) is **200 000 MPa**.

Answers (a) GH = 214 kN(T), GC = 0
(c) t = 2.13 mm
(d) ΔL = 3.16 mm



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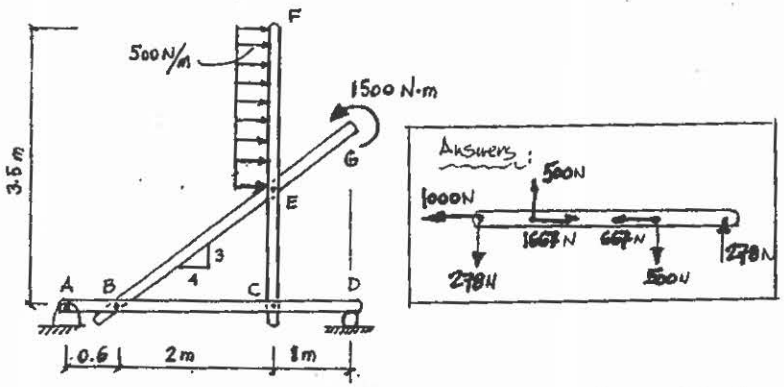

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