

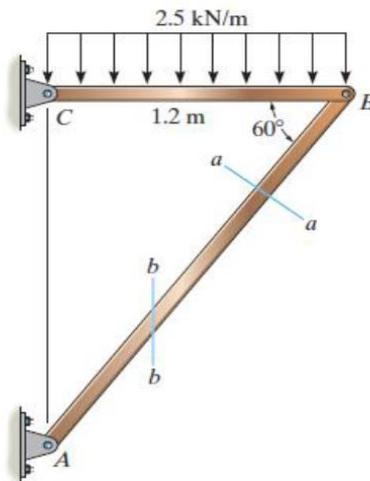
# BYG140 KONSTRUKSJONSMEKANIKK 1

## Assignment (4)

(Mechanics of Materials Ch 1: Stress, Ch 2: Strain, Ch 3: Mechanical Properties of Materials, Ch 4: Axial Load and Ch 6: Bending)

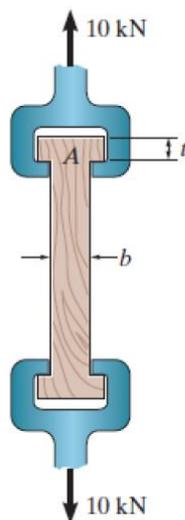
### Question 1

Determine the average normal stress at section  $a-a$  and average shear stress at section  $b-b$  in member  $AB$ . The cross section is square, 12mm on each side.



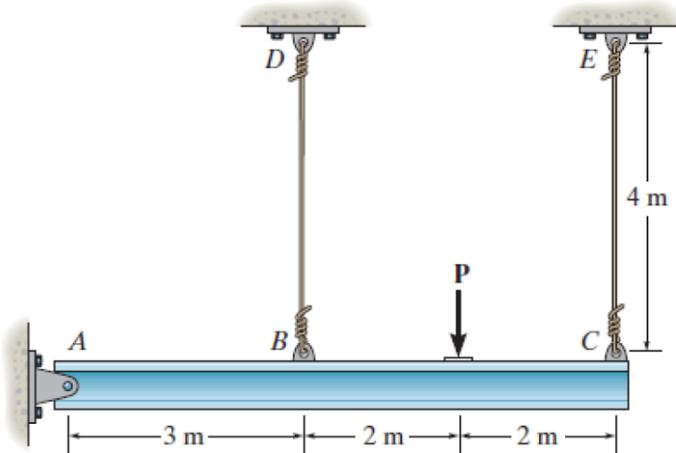
### Question 2

The wood specimen is subjected to the pull of  $10\text{ kN}$  in a tension-testing machine. If the allowable normal stress for the wood is  $(\sigma_t)_{allow} = 12\text{ MPa}$  and the allowable shear stress is  $\tau_{allow} = 1.2\text{ MPa}$  determine the required dimensions  $b$  and  $t$  so that the specimen reaches these stresses simultaneously. The specimen has a width of  $25\text{ mm}$ .



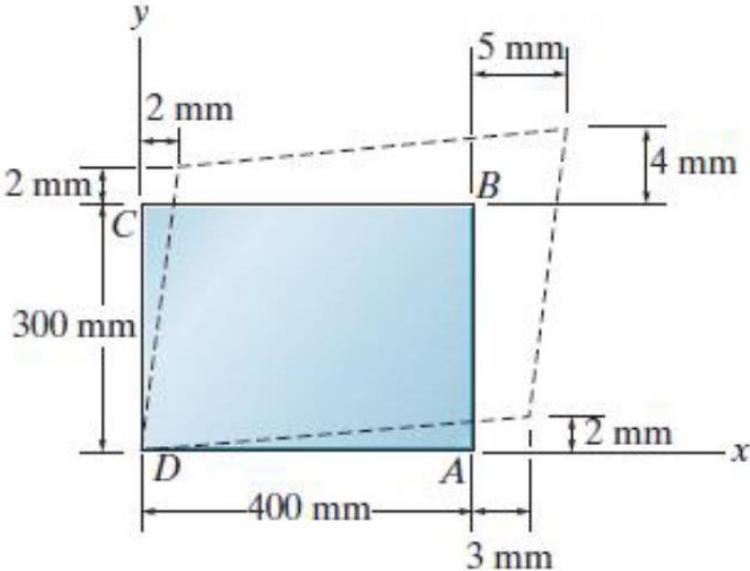
**Question 3**

The rigid beam is supported by a pin at *A* and wires *BD* and *CE*. If the load *P* on the beam causes the end *C* to be displaced 10mm downward, determine the normal strain developed in wires *CE* and *BD*.



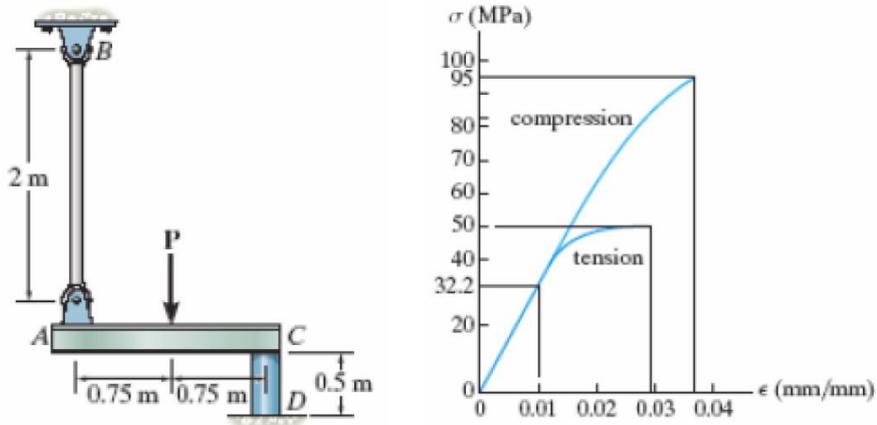
**Question 4**

The piece of plastic is originally rectangular. Determine the shear strain  $\gamma_{xy}$  at the corners *D* and *C* if the plastic distorts as shown by the dashed lines.



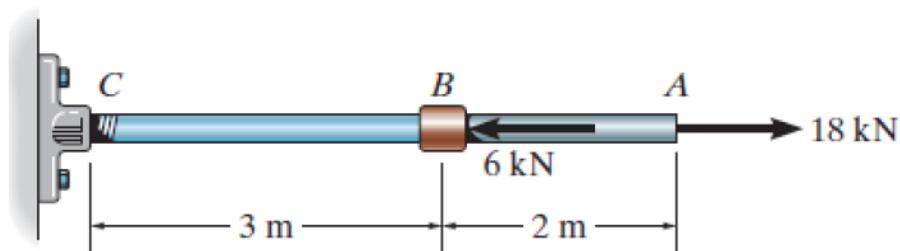
### Question 5

The strain stress diagram for a polyester resin is given in the figure. If the rigid beam is supported by a strut  $AB$  and  $CD$  made from this material, determine the largest load  $P$  that can be applied to the beam before it ruptures. The diameter of the strut is 12mm and the diameter of the post is 40mm.



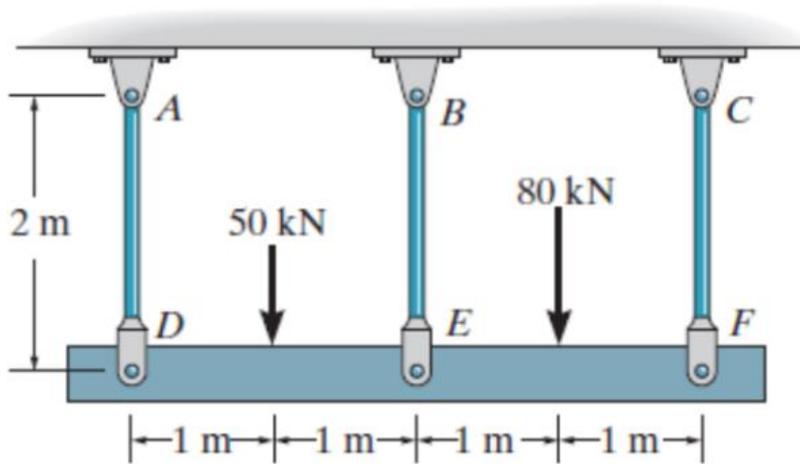
### Question 6

The assembly consists of a steel rod  $CB$  and an aluminium rod  $BA$ , each having a diameter of 12mm. If the rod is subjected to the axial loadings at  $A$  and at the coupling  $B$ , determine the displacement of the coupling  $B$  and the end  $A$ . The unstretched length of each segment is shown in the figure. Neglect the size of the connection at  $B$  and  $C$ , and assume that they are rigid.  $E_{st}=200\text{GPa}$ ,  $E_{al}=70\text{GPa}$ .



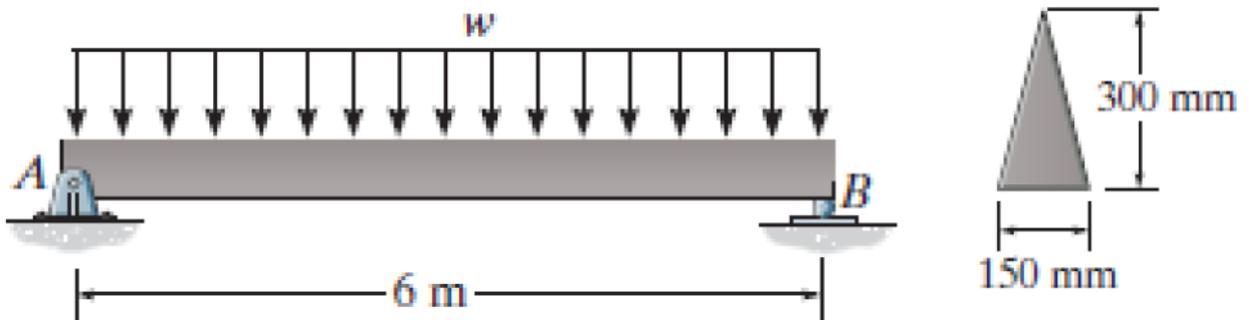
### Question 7

The three suspender bars are made of A992 steel and have equal cross sectional areas of  $450\text{mm}^2$ . Determine the average normal stress in each bar if the rigid beam is subjected to the loading shown.



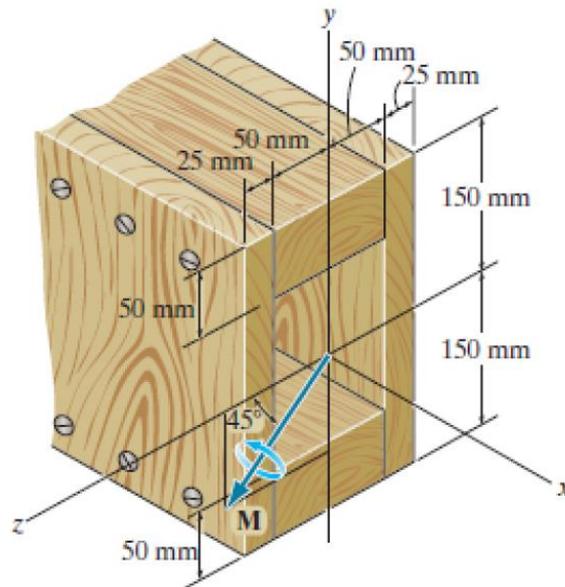
### Question 8

If the material of the beam has an allowable bending stress of  $\sigma_{allow} = 150\text{MPa}$ , Determine the maximum allowable intensity  $w$  of the uniform distributed load.



### Question 9

The box beam is subjected to the internal moment of  $M=4\text{kN m}$  which is directed as shown. Determine the maximum bending stress developed in the beam and the orientation of the neutral axis.



### Question 10

A wood beam is reinforced with steel straps at its top and bottom as shown. Determine the maximum bending stress developed in the wood and steel if the beam is subjected to a bending moment of  $M=5\text{kNm}$ . Sketch the stress distribution acting over the cross section. Take  $E_w=11\text{GPa}$ ,  $E_{st}=200\text{GPa}$ .

