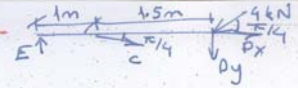
1) $\Sigma M_A=0 \quad -E(2.5)+\frac{4}{\sqrt{2}}\cdot 3=0 \quad E=3.39kN$



$\Sigma M_D=0 \quad -E(2.5)+C\frac{1}{\sqrt{2}}1.5=0 \quad C=7.99kN$

STRENGTH OF MATERIALS I

Midterm ,-12th November 2013

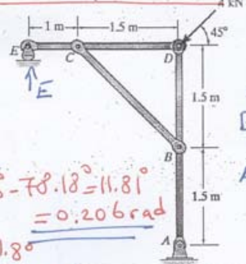
Student Name - Surname:

Student Number:

$\Sigma F_x=0 \quad \frac{C}{\sqrt{2}}+D_x-\frac{4}{\sqrt{2}}=0 \quad D_x=-2.82kN$ $\quad \Sigma F_y=0 \quad E-\frac{7.99}{\sqrt{2}}-D_y-\frac{4}{\sqrt{2}}=0 \quad D_y=-5.08kN$

$D=\sqrt{D_x^2+D_y^2}=5.81kN$

QUESTION 1. The frame is subjected to the load of 4 kN which acts on member ABD at point D. Determine the required diameter of the pins at D and C if the allowable shear stress for the material is τ_{allow}=40 Mpa. Pin C is subjected to double shear whereas pin D is subjected to single shear



C// $\tau_e=40=\frac{P}{A}=\frac{(8/2)kN}{A}$

$A=100mm^2 \quad d=11.28mm$

D// $40=\frac{5810}{A}$

$A=145.25mm^2$

$d=13.6mm$

2) $\tan\alpha=\frac{13}{16} \quad \alpha=39.09°=0.682rad$

$2(39.09)=78.18°=1.364rad \quad (\gamma_{xy})_A=90°-78.18°=11.81°=0.206rad$

$\tan\beta=\frac{16}{13} \quad \beta=50.906° \quad 2\times 50.906°=101.8°$

$90°-101.8°=-11.8°=-0.206rad$

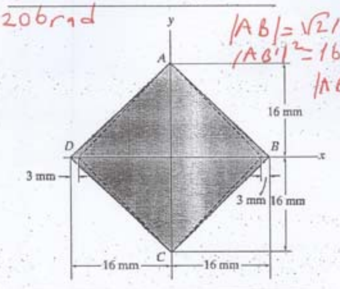
QUESTION 2. The corners B and D of the square plate are given the displacements indicated.

- **(a)** Determine the shear strains at A and B.
- **(b)** Determine the average normal strains along side AB and diagonal DB.

$|AB|=\sqrt{2}\,16=22.63mm$

$|AB'|^2=16^2+13^2$

$|AB'|=20,62mm$



$\varepsilon_{AB}=\frac{20,62-22,63}{22,63}=-0,0888$

$|DB|=32mm \quad |D'B'|=26mm$

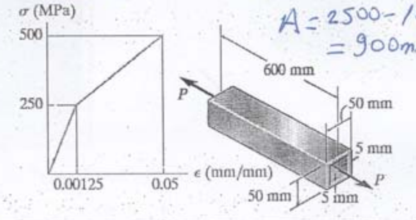
$\varepsilon_{DB}=\frac{26-32}{32}=-0,1875$

QUESTION 3.

Determine the elongation of the square hollow bar when it is subjected to the axial force P=100 kN. If this axial force is increased to P=360 kN and released, find the permanent elongation of the bar. The bar is made of a metal alloy having a stress-strain diagram which can be approximated as shown.

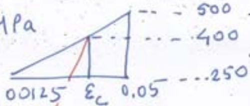
$E=\frac{250}{0,00125}=2\,10^5 MPa \qquad \frac{10^5}{900}=111.11MPa$ elastic

$A=2500-1600=900mm^2$



3) $\delta=\frac{Pl}{EA}=\frac{10^5\cdot 600}{2\,10^5\cdot 900}=0,33mm$

$\frac{360\,10^3}{900}=400MPa$



Başarılar dilerim.

$=\frac{400-250}{\varepsilon_c-0,00125}=\frac{500-250}{0,05-0,00125}$

$\varepsilon_c=0,03$

$\frac{400}{0,03-\varepsilon}=2\,10^5 \qquad \varepsilon=0,028$

$\delta=(0,028)(600)=16.8mm$