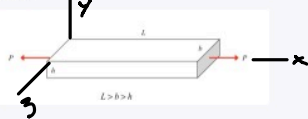


ME 323: Quiz #1 - Fall 2021

Q1 Poisson's ratio

2 Points



A uniaxial load P acts on a parallelepiped block having dimensions of $(L \times b \times h)$ as shown, with $L > b > h$. Let ΔL , Δb and Δh be the change in the L , b and h dimensions of the block resulting from the applied load. Choose the correct response below regarding this dimension changes.

☒ $\Delta b > \Delta h$

☐ $\Delta b = \Delta h$

☐ $\Delta b < \Delta h$

☐ more information is needed to answer this question

$$\epsilon_y = \epsilon_z$$

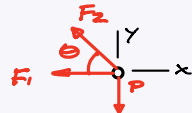
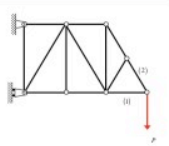
$$\Delta h = h \epsilon_y \Rightarrow \frac{\Delta h}{h} = \epsilon_y$$

$$\Delta b = b \epsilon_z \Rightarrow \frac{\Delta b}{b} = \epsilon_z$$

$$\Rightarrow \frac{\Delta h}{\Delta b} = \frac{h}{b} < 1$$

Q2 Factor of safety - 1

2 Points



$$\sum F_x = -F_1 - F_2 \cos \theta = 0$$

$$\Rightarrow |F_1| = |F_2| \cos \theta < |F_2|$$

Since $|F_2| > |F_1|$, the F.S. for 2 is less than for 1.

Consider the loading P on the truss shown. Members (1) and (2) of the truss are identical (made up of the same material, have the same length and have the same cross-sectional area). Let FS_1 and FS_2 represent the factor of safety against stress failure for members (1) and (2), respectively. Choose the correct response below regarding the relative sizes of these two factors of safety.

☒ $FS_1 > FS_2$

☐ $FS_1 = FS_2$

☐ $FS_1 < FS_2$

☐ more information is needed to answer this question

Q3 Factor of safety - 2

4 Points



Consider the uni-axially loaded rod above whose material has a Young's modulus of E and an ultimate strength of σ_U . Let FS represent the factor of safety against failure due to necking for this applied load.

Q3.1

2 Points

An increase in E of the material of the rod will:

☐ increase the value of FS .

☐ decrease the value of FS .

☒ leave the value of FS unchanged.

☐ more information is needed to answer this question

Stress is independent of $E \Rightarrow FS$ is independent of E

Q3.2

2 Points

An increase in σ_U of the material of the rod will:

☒ increase the value of FS .

☐ decrease the value of FS .

☐ leave the value of FS unchanged.

☐ more information is needed to answer this question

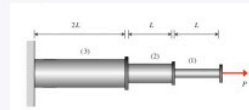
$$\sigma = P/A$$

$$FS = \frac{\sigma_U}{\sigma}$$

As σ_U is increased, FS is increased

Q4 Axial loads in rods

2 Points



Axial load through all three members is the same
 $(=P) \Rightarrow F_1 = F_2 = F_3 = P$

A three-segment rod is loaded with an axial load P at the connector on the right end. All three sections are made up of the same material, and the cross-sectional areas of the three segments are ordered by $A_1 < A_2 < A_3$. Let F_1 , F_2 and F_3 represent the axial loads (forces) carried by segments 1, 2 and 3, respectively. Choose the correct response below regarding the relative sizes of the axial loads in the members:

☐ $|F_1| > |F_2| > |F_3|$

☒ $|F_1| = |F_2| = |F_3|$

☐ $|F_1| < |F_2| < |F_3|$

☐ more information is needed to answer this question

Q5 Shear stress failure

2 Points



As seen in lecture, uni-axial loads do produce shear stresses

Consider the uni-axial load on the rod shown above.

TRUE or FALSE: The material in the rod cannot fail due to shear.

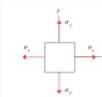
☐ TRUE

☒ FALSE

☐ more information is needed to answer this question

Q6 Stress/strain relations

2 Points



Hookes law:

$$\epsilon_x = \frac{1}{E} [\sigma_x - \nu \sigma_y]$$

$$\neq \frac{1}{E} \sigma_x$$

Consider the state of stress shown above in a linearly elastic material having a Young's modulus of E . Let ϵ_x represent the x-component of strain in the material with this loading. TRUE or FALSE: The stress/strain relation for this state of stress is $\epsilon_x = E \sigma_x$.

☐ TRUE

☒ FALSE

☐ more information is needed to answer this question