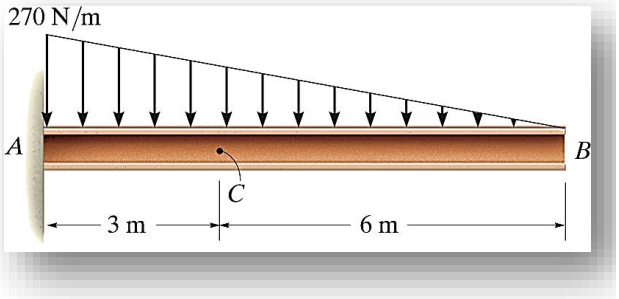
ME212 Strength of Materials 2023-2024

Chapter 1- Examples

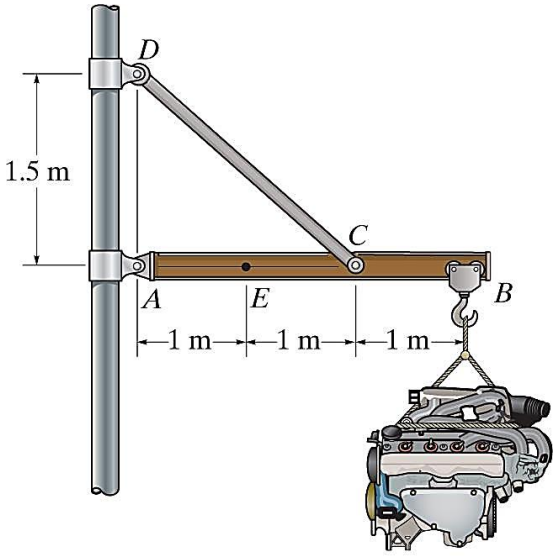
Exp. 1

Determine the resultant internal loadings acting on the cross section at C of the cantilevered beam shown in the Figure.



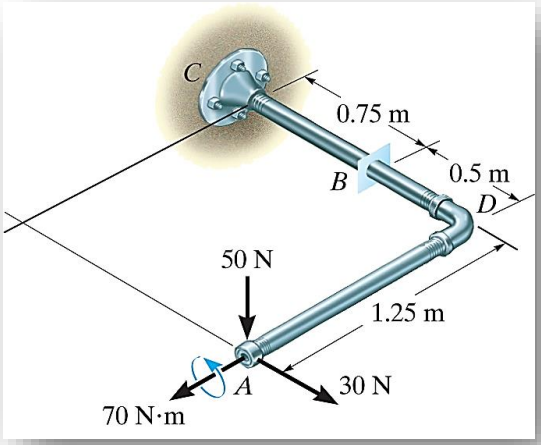
Exp. 2

The 500 kg engine is suspended from the crane boom in the Figure. Determine the resultant internal loadings acting on the cross section of the boom at point *E*.



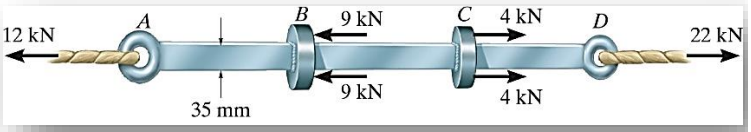
Exp.3

Determine the resultant internal loadings acting on the cross section at B of the pipe shown in Figure. End A is subjected to a vertical force of 50 N, a horizontal force of 30 N and a couple moment of 70 N.m. Neglect the pipe's mass.



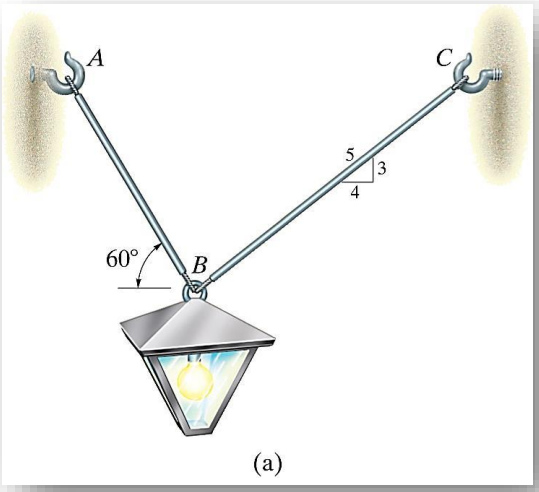
Exp.4

The bar in the Figure has a constant width of 35 mm and a thickness of 10 mm. Determine the maximum average normal stress in the bar when it is subjected to the loading shown



Exp.5

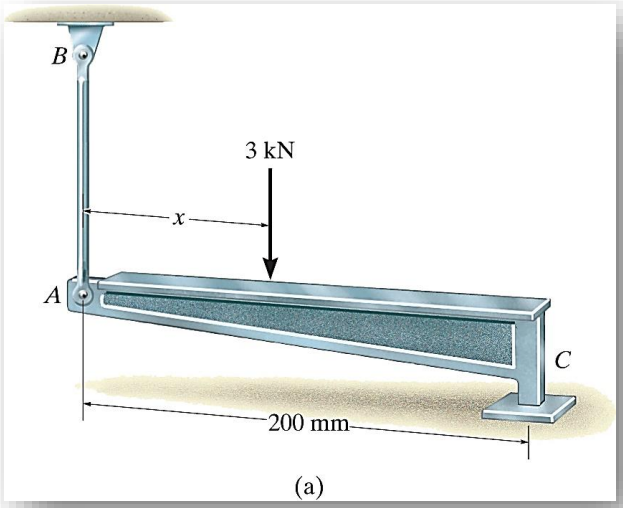
80-kg lamp is supported by two rods AB and BC as shown in Figure(a). If AB has a diameter of 10 mm and BC has a diameter of 8 mm, determine the average normal stress in each rod.



(a)

Exp.6

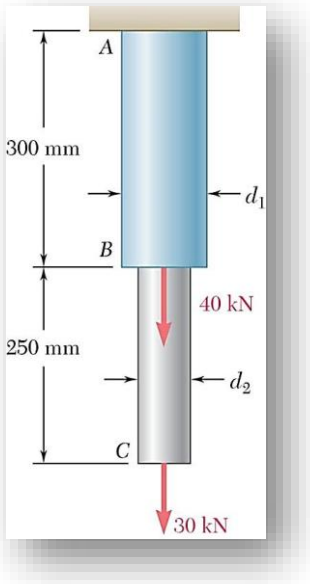
Member AC shown in Figure(a) is subjected to a vertical force of 3 kN. Determine the position x of this force so that the average compressive stress at smooth support C is equal to the average tensile stress in the tie rod AB. The rod has a cross-sectional area of 400 mm^2 and the contact area at C is 650 mm^2.



(a)

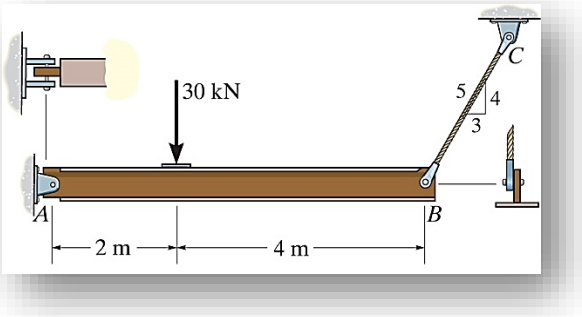
Exp.7

Two solid cylindrical rods AB and BC are welded together at B and loaded as shown. Knowing that the average normal stress must not exceed 175 MPa in rod AB and 150 MPa in rod BC, determine the smallest allowable values of d_1 and d_2.



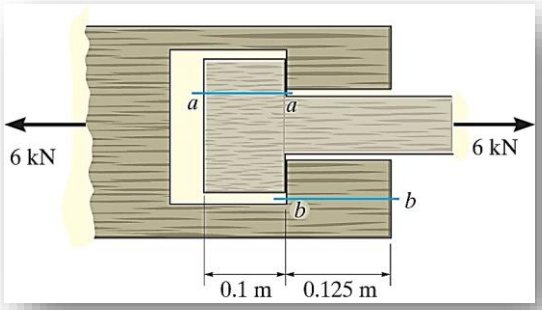
Exp.8

Determine the average shear stress in the 20-mm-diameter pin at A and the 30-mm-diameter pin at B that support the beam in the figure.



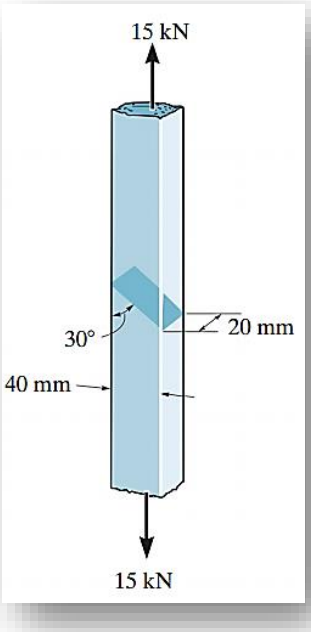
Exp.9

If the wood joint in the Figure has a thickness of 150 mm, determine the average shear stress along shear planes $a-a$ and $b-b$ of the connected member. For each plane, represent the state of stress on an element of the material.



Exp.10

The two steel members are joined together using a 30° scarf weld. Determine the average normal and average shear stress resisted in the plane of the weld.



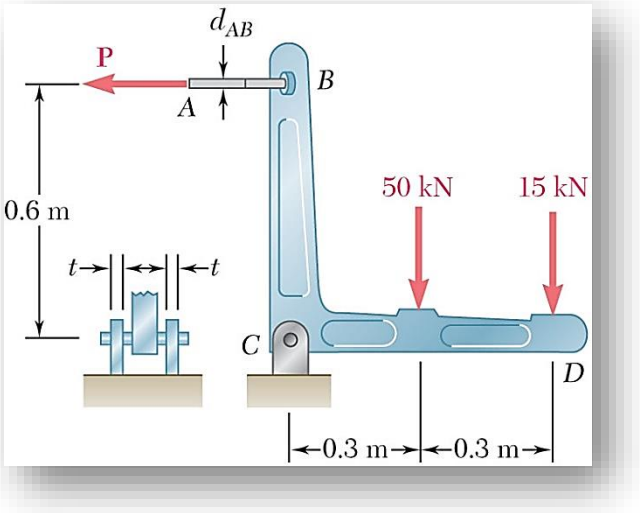
Exp.11

Two forces are applied to the bracket BCD as shown.

a) Knowing that the control rod AB is to be made of a steel having an ultimate normal stress of 600 MPa, determine the diameter of the rod for which the factor of safety with respect to failure will be 3.3,

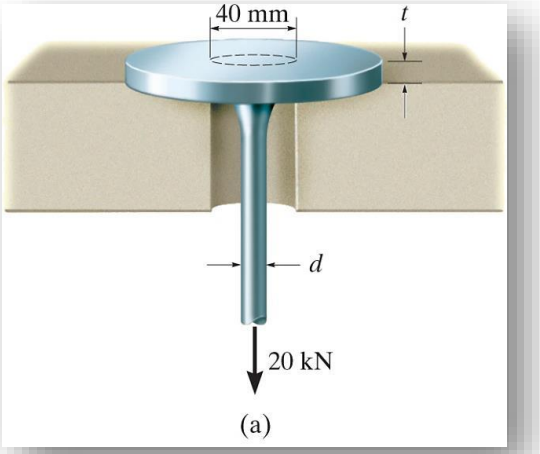
b) The pin at C is to be made of a steel having an ultimate shearing stress of 350 MPa. Determine the diameter of the pin C for which the factor of safety with respect to shear will also be 3.3,

c) Determine the required thickness of the bracket supports at C knowing that the allowable bearing stress of the steel used is 300 MPa.



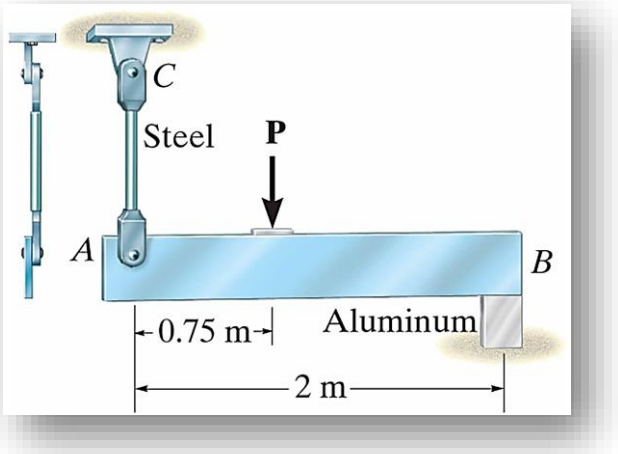
Exp.12

The suspender rod is supported at its end by a fixed-connected circular disk as shown in Fig.(a). If the rod passes through a 40-mm-diameter hole, determine the minimum required diameter of the rod and the minimum thickness of the disk needed to support the 20-kN load. The allowable normal stress for the rod is σ_{allow}= 60 MPa, and the allowable shear stress for the disk is τ_{allow}= 35 MPa.



Exp.13

The rigid bar AB shown in the figure is supported by a steel rod AC having a diameter of 20 mm and an aluminum block having a cross-sectional area of 1800 mm^2. The 18-mm-diameter pins at A and C are subjected to single shear. If the failure stress for the steel and aluminum is $(\sigma_{st})_{fail} = 680$ MPa and $(\sigma_{al})_{fail} = 70$ MPa , respectively, and the failure shear stress for each pin is $\tau_{fail} = 900$ MPa, determine the largest load P that can be applied to the bar. Apply a factor of safety of F.S. $= 2$.



Exp.14

The steel tie bar shown is to be designed to carry a tension force of magnitude P = 120 kN when bolted between double brackets at A and B. The bar will be fabricated from 20-mm-thick plate stock. For the grade of steel to be used, the maximum allowable stresses are $\sigma = 175$ MPa, $\tau = 100$ MPa, and $\sigma_b = 350$ MPa. Design the tie bar by determining the required values of (a) the diameter d of the bolt, (b) the dimension b at each end of the bar, and (c) the dimension h of the bar.