Machine Design-I-

ME356

Sheet-1-

Fall Semester

2011/2012

SHEET (1)

STRESSES

1. In the steel structure shown if Fig.P1, a 6-mm-diameter pin is used at C and 10-mm diameter pins are used at B and D. The ultimate shearing stress is 150 MPa at all connections, and the ultimate normal stress is 400 MPa in link BD. Knowing that a factor of safety of 3 is desired, determine the largest load P which may be applied at A.

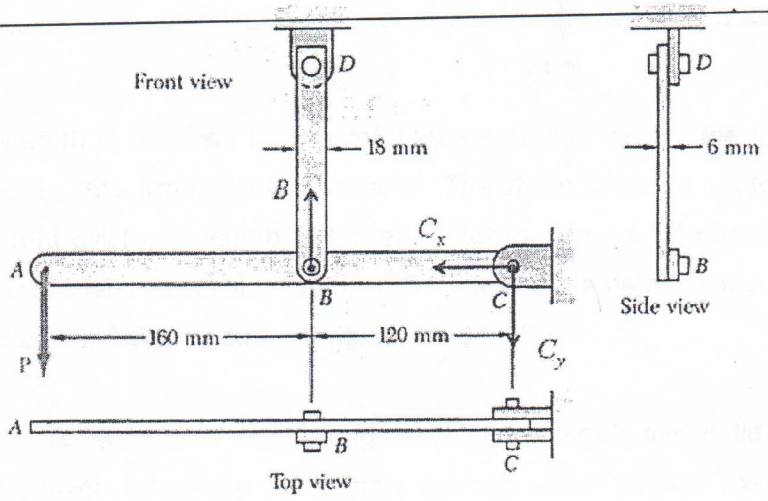


Fig. P1

2. Each of the two vertical links CF connecting the two horizontal members AD and EG, shown in Fig. P2, has a 10×40-mm uniform rectangular cross section and is made of a steel with an ultimate strength in tension of 400 MPa, while each of the pins at C and F has a 20-mm diameter and is made of a steel with an ultimate strength in shear of 150 MPa. Determine the overall factor of safety for the links CF and the pins connecting them to the horizontal members

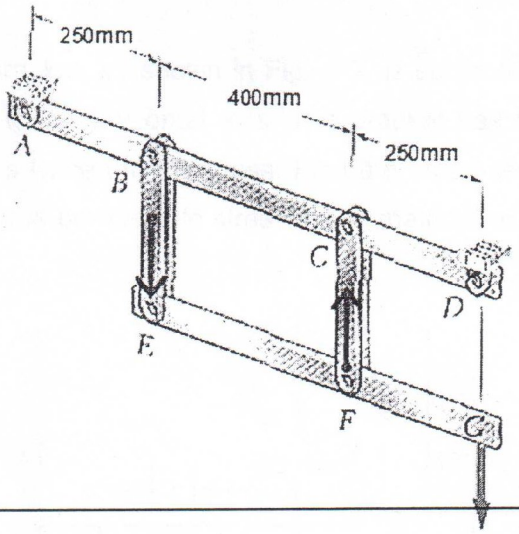


Fig.P2

3. A hollow shaft is required to transmit 600 kW at 110 r.p.m., the maximum torque being 20% greater than the mean. The shear stress is not to exceed 63 MPa and twist in a length of 3 meters not to exceed 1.4 degrees. Find the external diameter of the shaft, if the internal diameter to the external diameter is 3/8. Take modulus of rigidity as 84 GPa.

4. Compare the weights of equal lengths of hollow shaft and solid shaft to transmit a given torque for the same maximum shear stress. The material for both the shafts is same and inside diameter is 2/3 of outside diameter in case of hollow shaft.

5. A shaft is supported in bearings, the distance between their centers being 1 meter. It carries a pulley in the center and it weighs 1 kN. Find the diameter of the shaft, if the permissible bending stress for the shaft material is 40 MPa.

6. A beam of uniform rectangular cross-section is fixed at one end and carries an electric motor weighing 400 N at a distance of 300 mm from the fixed end. The maximum bending stress in the beam is 40 MPa. Find the width and depth of the beam, if depth is twice that of width.

7. A mild steel bracket, as shown in Fig. P7, is subjected to a pull of 6000 N acting at 45° to its horizontal axis. The bracket has a rectangular section whose depth is twice the thickness. Find the cross-sectional dimensions of the bracket, if the permissible stress in the material of the bracket is limited to 60 MPa.

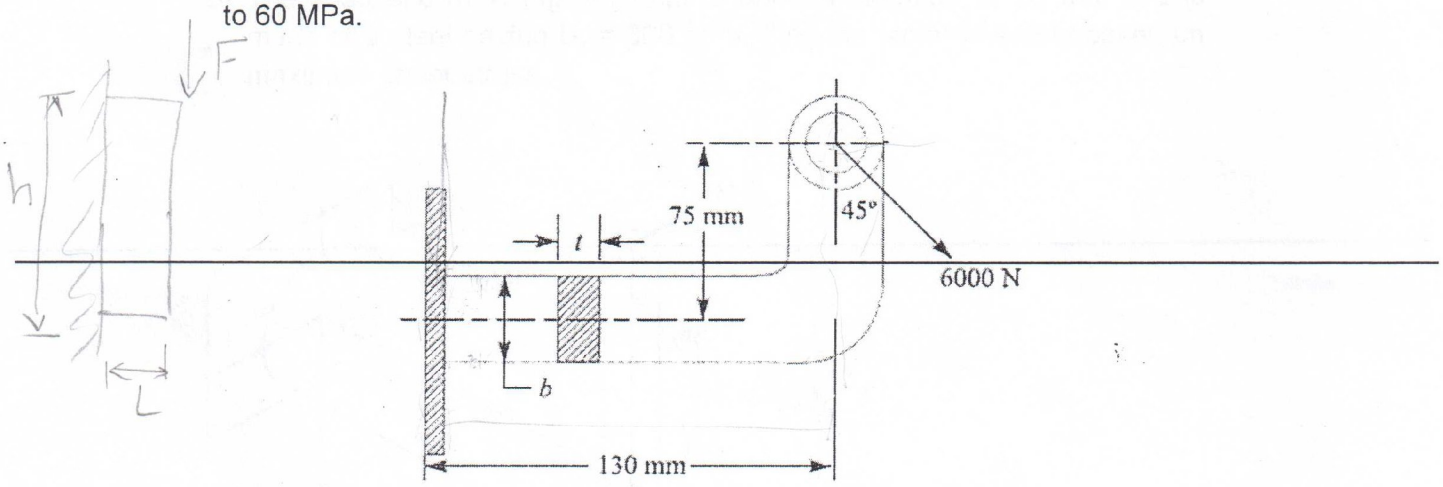


Fig. P7

8. A shaft, as shown in Fig. P8, is subjected to a bending load of 3 kN, pure torque of 1000 N-m and an axial pulling force of 15 kN. Calculate the maximum normal and shear stresses.

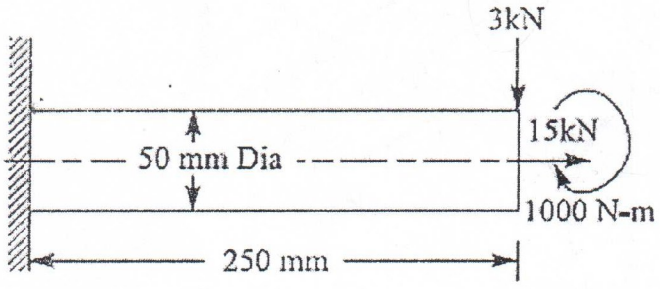
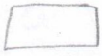


Fig. P8

Max. shear due to bending



$\tau_{max} = \frac{3F}{2A}$

$\tau_{max} = \frac{4F}{3A}$

$\tau_{max} = \frac{2F}{A}$

9. The member shown in Fig. P9 is fixed at its end and loaded with perpendicular loads 1KN and 2kN. Calculate the maximum normal and shear stresses.

10. The shaft shown in Fig. P10 has a uniform diameter of 30 mm and is made of a steel having S_y = 300 MPa. Find the factor of safety based on maximum shear stress.

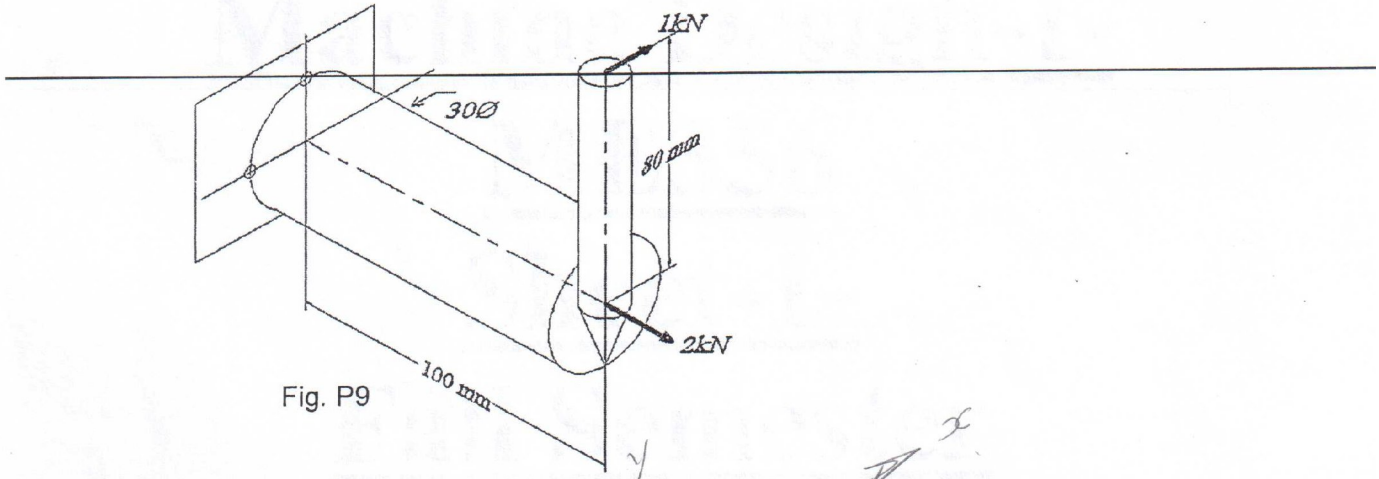


Fig. P9

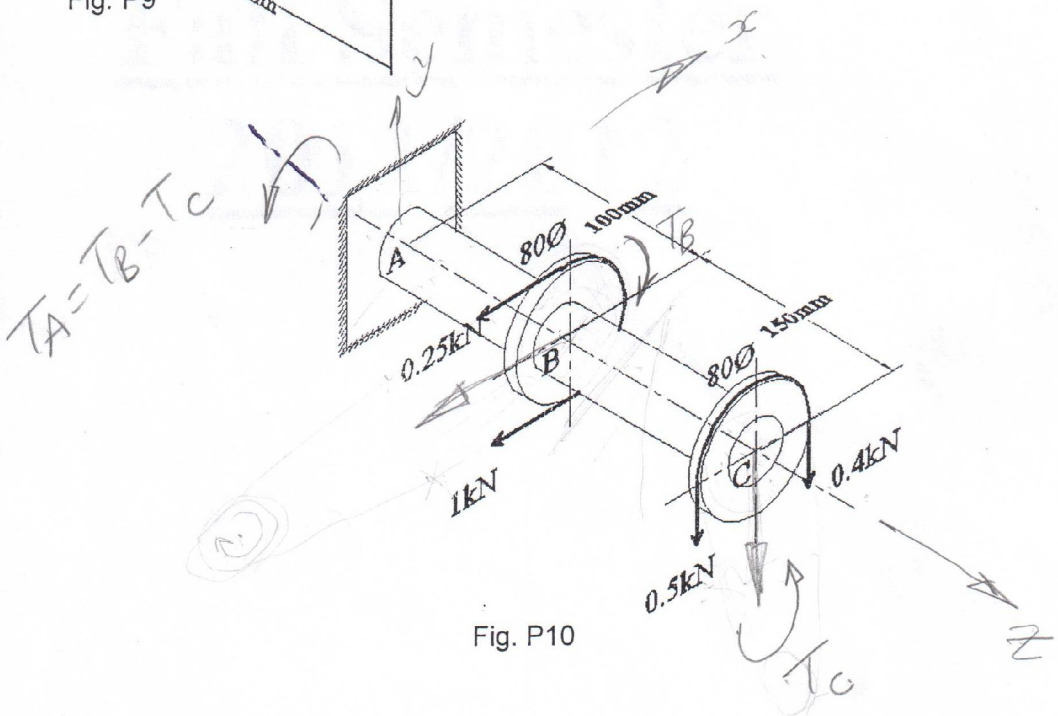


Fig. P10