1. A thin strip of rubber has an unstretched length of 385 mm. If it is stretched around a pipe having an outer diameter of 135 mm, determine the average normal strain in the strip. (15%)

2. The open-ended polyvinyl chloride pipe has an inner diameter of 120 mm and thickness of 6 mm, as shown in Fig. 1. If it carries flowing water at 0.45 MPa pressure, determine the state of stress in the walls of the pipe. (15%)
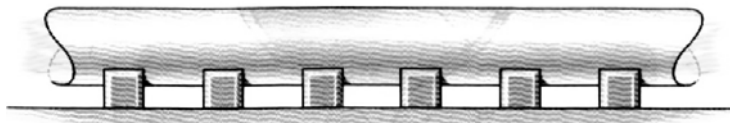
Fig. 1

3. A steel tube having an outer diameter of 55 mm is used to transmit 4 kW when turning at 45 rev/min, see Fig. 2. Determine the inner diameter d of the tube to the nearest multiples of 5 mm if the allowable shear stress τ_{allow} is 64 MPa. (15%)

55 mm
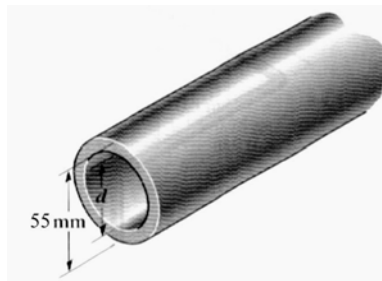
Fig. 2

4. The steel rod has a radius of 25 mm, as shown in Fig. 3. If it is subjected to a shear of V= 40 kN, determine the maximum shear stress. (15%)
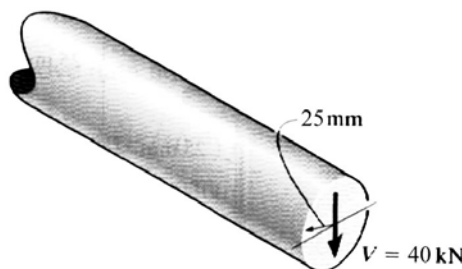
25 mm

$V = 40\,kN$

Fig. 3

5. The anchor shackle supports a cable force of 3.0 kN as shown in Fig. 4. If the pin has a diameter of 6 mm, determine the average shear stress in the pin. (20%)
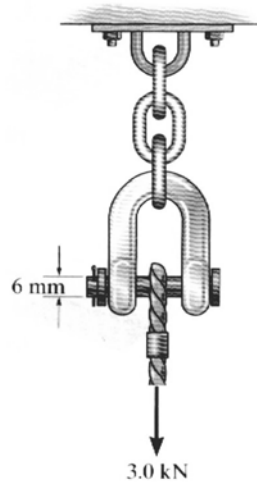

6 mm

3.0 kN

Fig. 4

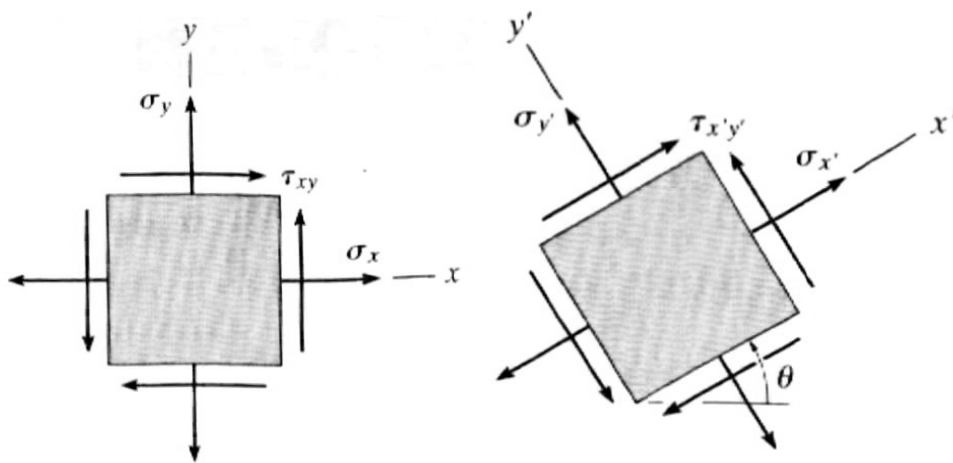6. Prove that the sum of the normal stresses $\sigma_x + \sigma_y = \sigma_{x'} + \sigma_{y'}$, see Fig. 5. (20%)

Fig. 5