系所： <u>工業教育與技術學系</u>　　　組別： <u>乙組</u>　　　科目：<u>材料力學</u>

1. An air-filled rubber ball has a diameter of 160 mm. If the air pressure within it is increased until the ball's diameter becomes 185 mm, determine the average normal strain in the rubber. (15%)

2. A specimen is originally 350 mm long, has a diameter of 15 mm, and is subjected to a force of 2.5 kN. When the force is increased to 9 kN, the specimen elongates 22 mm. Determine the modulus of elasticity for the material if it remains elastic. (15%)

3. For the beam and loading shown in Fig. 1, draw the shear and bending- moment diagrams. (15%)
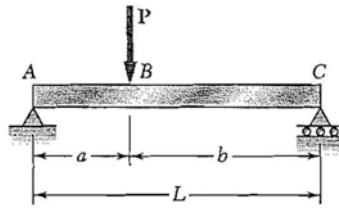


Fig. 1

4. A shaft is made of a steel alloy having an allowable shear stress of $\tau_{max} = 95\,MPa$ in Fig. 2. If the diameter of the shaft is 37.5 mm, determine the maximum torque $T$ that can be transmitted. What would be the maximum torque $T'$ if a 25-mm-diameter hole is bored through the shaft? (20%)
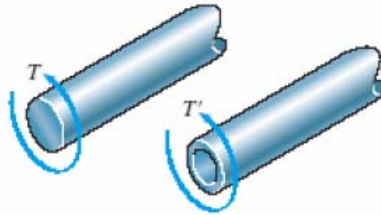


Fig. 2

5. Two 12 kN vertical forces are applied to a beam with U shape cross section, see Fig. 3. Determine the maximum tensile and compressive stresses in portion BC of the beam. (20%)
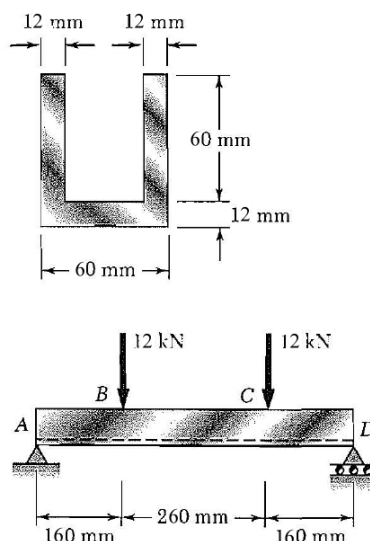


Fig. 3

6. A bridge structure with a = 35 mm and b = 300 mm, see Fig. 4, determine the shearing modulus G and the shear stress $\tau$ for a maximum lateral load P = 25 kN and a maximum displacement $\delta$ = 15 mm. (15%)
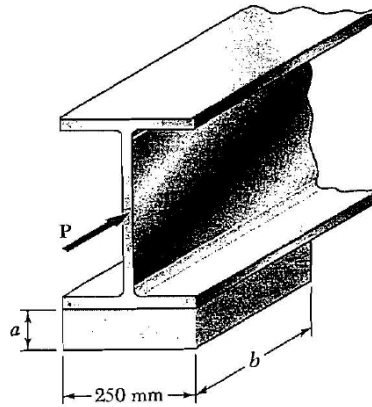


Fig. 4