1. The 20-mm-diameter A-36 steel rod is subjected to the axial forces as shown in the figure. The modulus of elasticity of A-36 steel is 200 GPa. Determine the displacement of end C with respect to the fixed support at A. (12.5%)

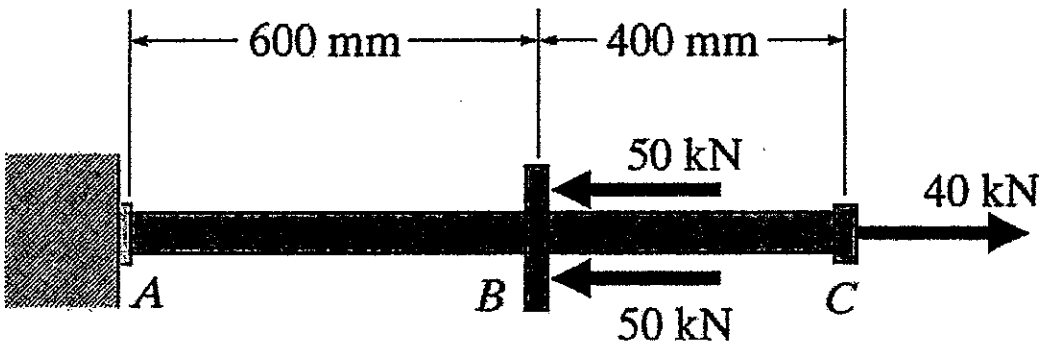

Figure P1

2. An A-36 steel strap having a thickness of 10 mm and a width of 20 mm is bent into a circular arc having the radius of curvature of 10 m. The modulus of elasticity of A-36 steel is 200 GPa. Determine the maximum bending stress in the strap. (12.5%)

3. The gear motor can develop $300\pi^2$ (W) when it turns at 180 (rev/min). If the allowable shear stress for the shaft is $\tau_{allow} = 100$ (MPa), determine the smallest allowable diameter of the shaft. (12.5%)

4. A 1.25-m-long rod is made from a 25-mm-diameter steel rod. The modulus of elasticity of steel is 200 GPa. Determine the critical buckling load if both ends of the rod are fixed supported. (12.5%)

5. A point on the surface of a material is subjected to biaxial stresses $\sigma_x = 10$ MPa and $\sigma_y = 5$ MPa. Using Mohr's circle to determine the stresses acting on an element inclined at an angle 60°. (10%)

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6. A cylindrical pressure vessel with an inner radius r = 2 m and wall thickness t = 25 mm. The vessel is made of steel with modulus of elasticity E = 210 GPa and Poisson's ratio v = 0.3. The internal pressure p is 1000 kPa.
   (a) Determine the circumferential stress and longitudinal stress. (10%)
   (b) The vessel is made by welding steel sheet with an angle $\theta = 60°$, determine the normal stress and shear stress acting perpendicular and parallel to the welding line. (10%)

Figure P6

7. A tapered bar AB of solid circular cross section and length L = 15 mm is supported at end B and subject to a tensile load P = 500 N at the free end A. The diameter of the bar at end A is 4 mm and the diameter at the end B is 10 mm. The bar is made of steel with modulus of elasticity E = 210 GPa. Determine the elongation of the bar due to the load P. (10%)

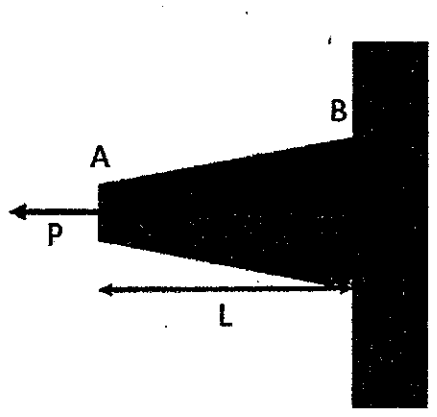

Figure P7

8. A wire of diameter d = 3.5 mm is bend around a cylindrical drum of radius R = 60 cm. The wire is made of steel with modulus of elasticity E = 210 GPa. Determine the bending moment and maximum bending stress. (10%)

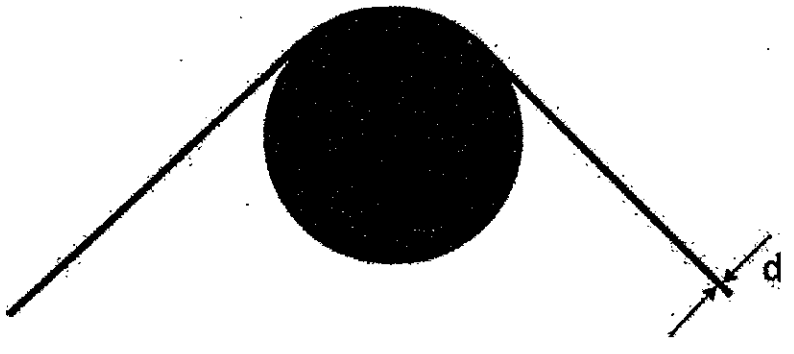

Figure P8

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