1. In an experiment involving the behaviour of a thin wire of 0.25mm diameter, a mass of 5 kg is suspended from the wire and a torque of 1.72 mNm is applied. Calculate the in-plane principal stresses and the maximum shear stress for this case.
   [Ans.: $\sigma\sigma_1$ = 1250.5 MPa, $\sigma\sigma_2$ = -251.3 MPa, τ_{max} = 751 MPa]

2. A thin-walled cylindrical tank is subjected to an internal pressure of 300 kPa and a torsional moment of 15kNm. The outer radius of the tank is 250 mm and the wall thickness is 1 mm. Calculate
   i) the in-plane principal stresses and the maximum in-plane shear stress
   ii) the overall maximum shear stress for the stress system
   [Ans.: i) $\sigma\sigma_1$ = 98.95 MPa, $\sigma\sigma_2$ = 13.55 MPa, τ_{max} = 42.7 MPa;
   ii) τ_{max} = 49.48 MPa]

3. A helicopter rotor shaft, 50mm in diameter, transmits a torque of 2.4 kNm and an upward tensile lifting force of 125 kN. Determine the maximum tensile stress, maximum compressive stress and maximum shear stress in the shaft.
   [Ans.: σ_1 = 134.6 MPa, $\sigma\sigma_2$ = -71 MPa, τ_{max} = 102.8 MPa]

4. A generator shaft of hollow circular cross-section is subjected to a torque of 25 kNm and a compressive load of 900 kN. The outer and inner diameters of the shaft are 200 mm and 160 mm respectively. Determine the in-plane principal stresses and maximum shear stress.
   [Ans.: $\sigma\sigma_1$ = 8.3 MPa, σ_2 = -87.9 MPa, τ_{max} = 48.1 MPa]

5. For the purpose of analysis, a segment of a crankshaft in a vehicle is presented as shown in Figure Q5. The load P = 1 kN, and the dimensions are b1 = 80 mm, b2 = 120 mm and b3 = 40mm. The diameter of the shaft is d = 20 mm. Determine the maximum tensile, compressive and shear stresses at point A, located on the surface of the shaft at the z-axis.
   [Ans.: $\sigma\sigma_1$ = 31.6 MPa, $\sigma\sigma_2$ = -184.6 MPa, τ_{max} = 108.1 MPa]

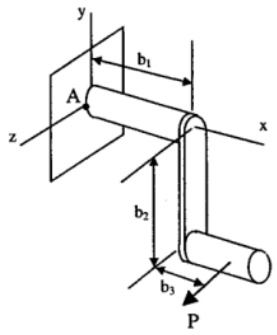

Figure Q5