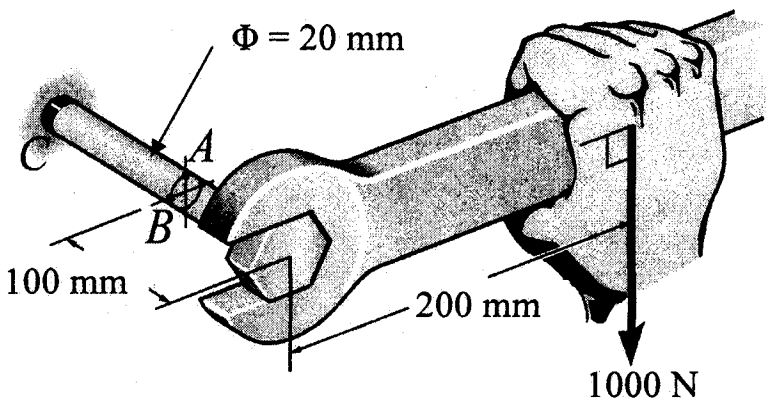
**********材料力學作答不得使用計算機**********

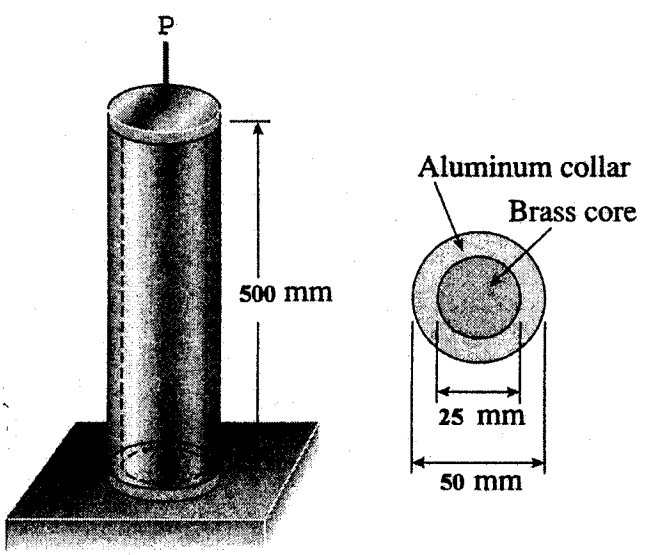
1. A bolt is fixed to its support at C. A load of 1000 N is applied to the wrench to tighten the bolt. The bolt is 10 mm in diameter.
   (a) Determine the principal stresses and the absolute maximum shear stress developed in the bolt at point A as shown in figure 1.
   (b) Draw a stress element to show the stress state at point A and plot a Mohr's circle to represent the stress state at A and indicate the principal stresses and the maximum shear stress on the Mohr's circle. (20 points)

Figure 1



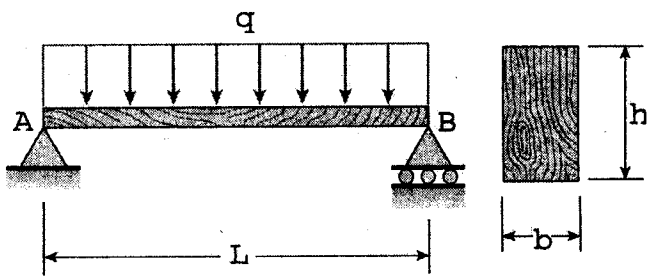
2. A cylindrical assembly consisting of a brass core and an aluminum collar is compressed by a load P (see figure 2). The length of the aluminum collar and brass core is 500 mm, the diameter of the core is 25 mm, and the outside diameter of the collar is 50 mm. Also the moduli of elasticity of the aluminum and brass are assumed to be 50GPa and 100GPa, respectively.
   (a) If the length of the assembly decreases by 0.1% when the load P is applied, what is the magnitude of the load?
   (b) What is the maximum permissible load P_{max} if the allowable stresses in the aluminum and brass are 50 MPa and 150 MPa, respectively? (20 points)

Figure 2



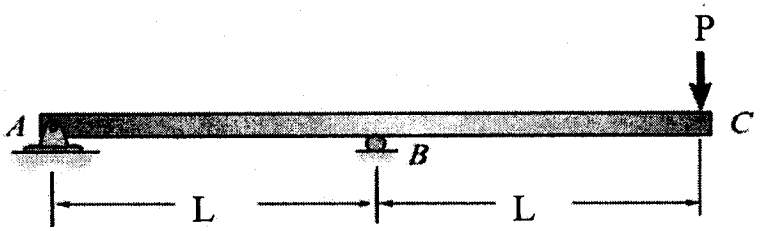
3. A simply supported wooden beam AB with span length L = 5 m carries a uniform load of intensity q = 10 kN/m (see figure 3). Calculate the maximum bending stress σ_{max} due to the load q if the beam has a rectangular cross section with width b= 10 mm and height h= 100 mm. (20 points)

Figure 3



4. A load of magnitude P is exerted at point C of the overhanging beam shown in figure 4. (1) Draw the shear force and bending moment diagrams of the beam. (2) Determine the displacement at point C by using ***MOMENT AREA METHOD***. The Young's modules of the beam is E and the moment inertia of the beam is I. (If you use other methods, you'll get maximum 10 instead of 20 points even if your answer is perfectly correct.) (20 points)

Figure 4



5. A rigid bar ***AB*** is supported vertically at end ***B*** by a spherical joint and laterally supported by two identical springs of spring constant ***k*** at end ***A*** as shown in the following figure. An axial force ***F*** is eccentrically applied at end A with a small eccentricity ***e***. The spring is free of stress when the bar ***AB*** is in its vertical position. Please derive the critical value of external force F. (20 points)

Figure 5