

國立清華大學 100 學年度碩士班入學考試試題

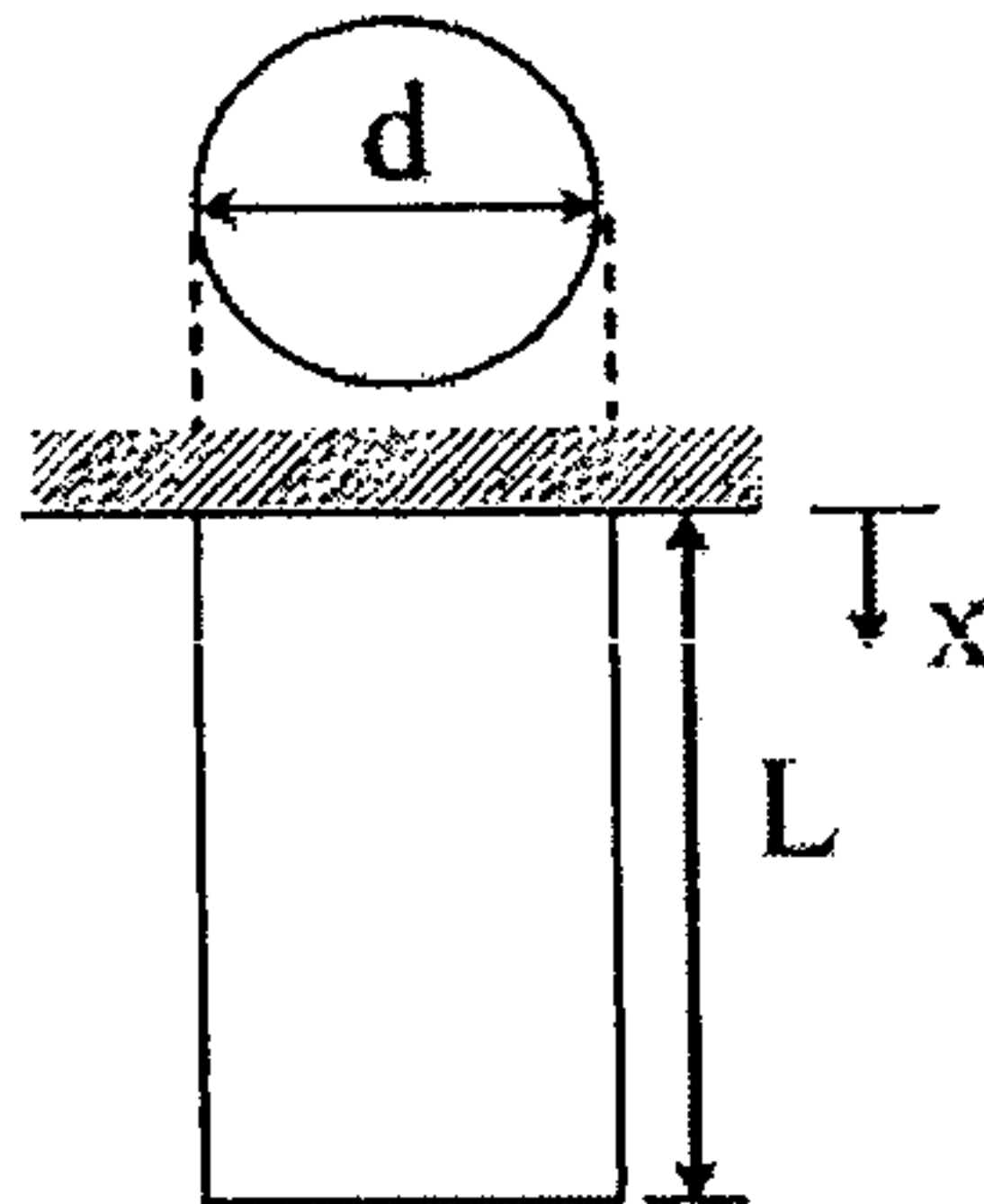
系所班組別：動力機械工程學系丙組(固體與奈微米力學組)

考試科目 (代碼)：材料力學 (1201)

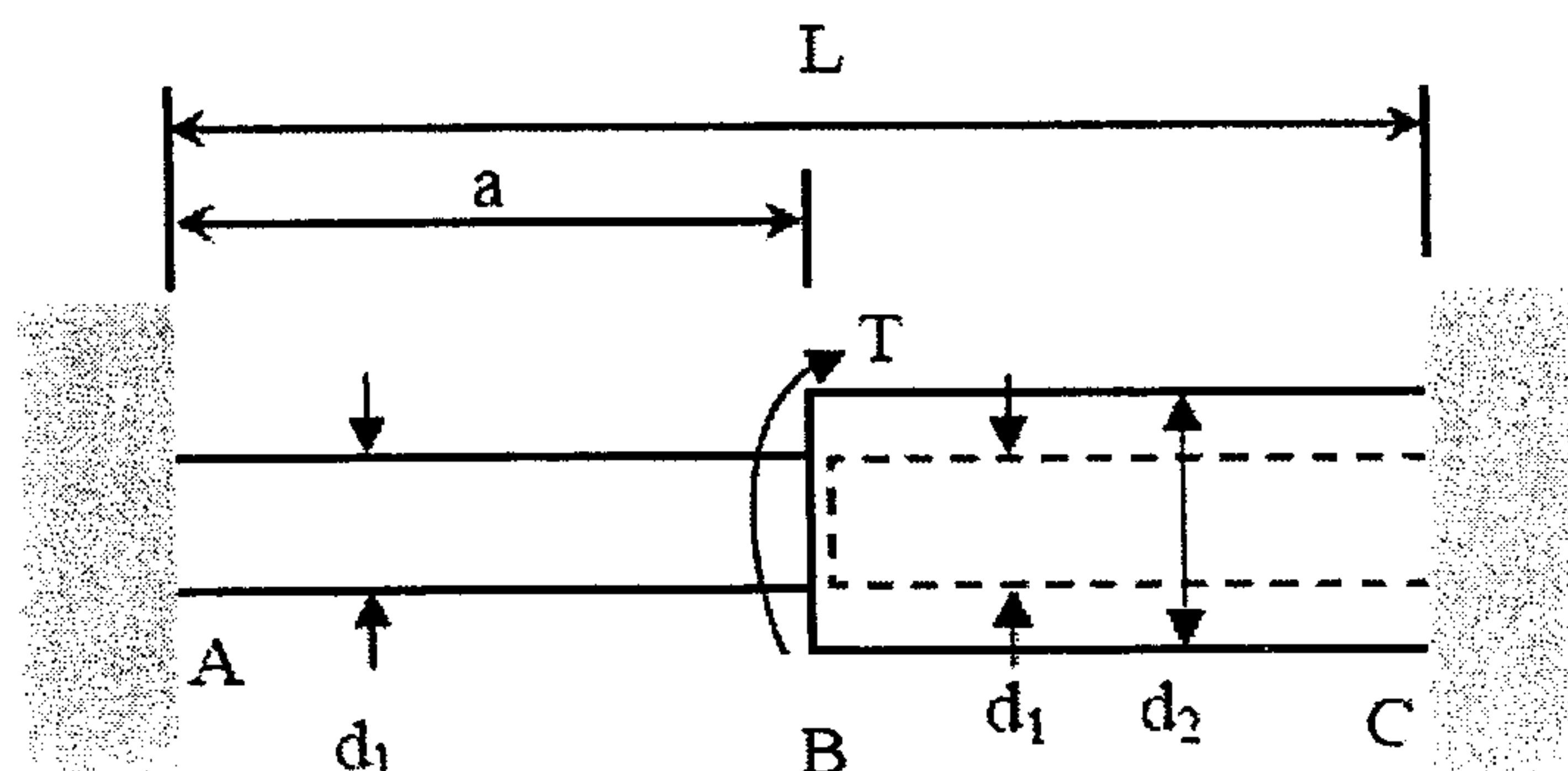
共 2 頁，第 1 頁

*請在【答案卷、卡】作答

1. Explain the following terms. (25%, 5% each)
 - (a) strain hardening
 - (b) factor of safety
 - (c) modulus of resilience
 - (d) shear flow in thin-walled tubes
 - (e) plane stress
2. A bar of circular cross-section (Young's modulus E , and density ρ (mass per unit volume)) is shown in figure below. Derive a formula for the elongation δ of the bar due to its self weight. (15%)



3. A bar ABC built in at both ends is subjected to a torque T at section B, as shown in figure below. The bar has a solid, circular cross section (diameter d_1) from A to B, and a hollow, circular section from B to C (outer diameter d_2 , and inner diameter d_1). Derive an expression for the ratio a/L such that the reactive torques at A and C are equal numerically. (15%)



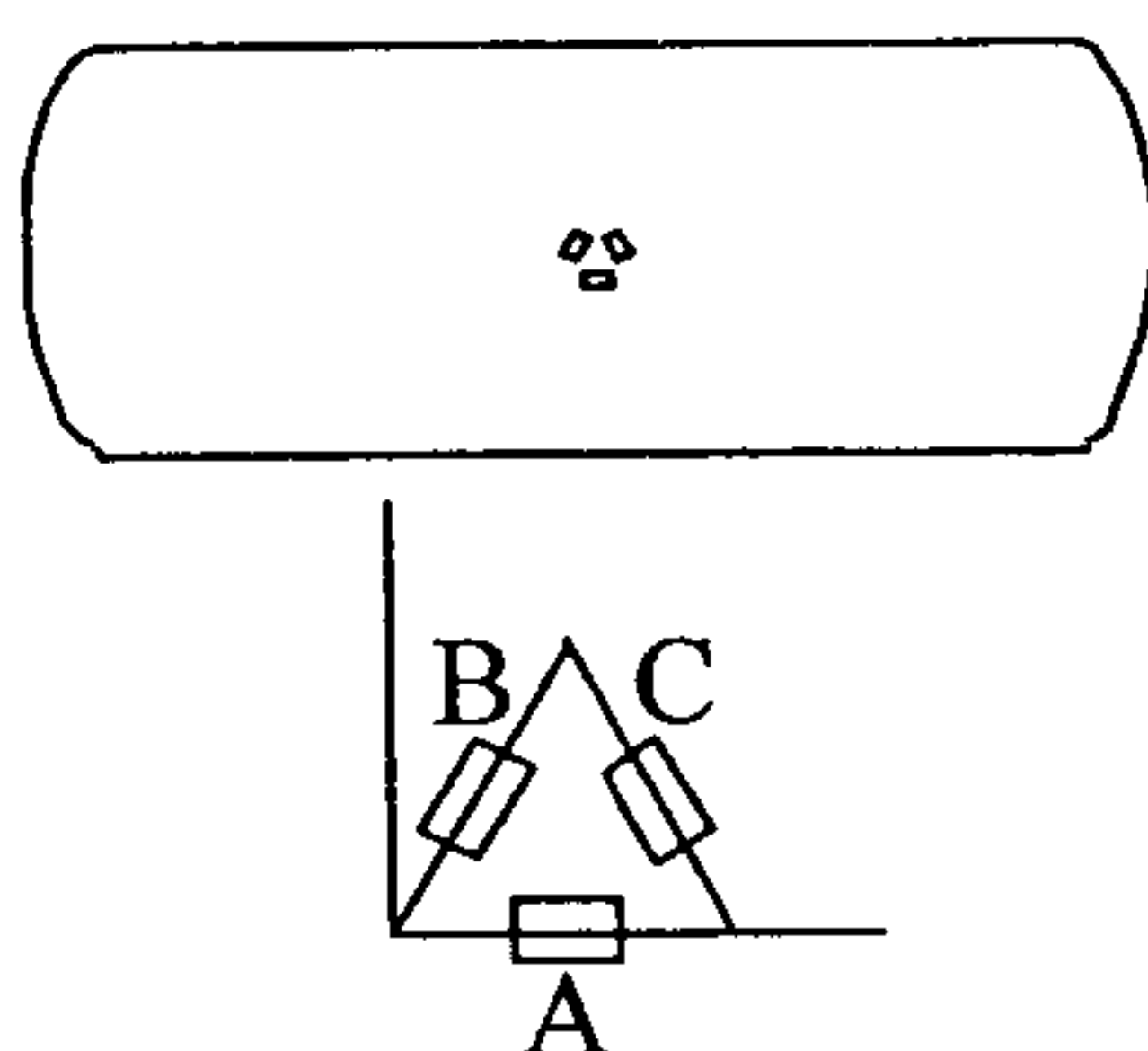
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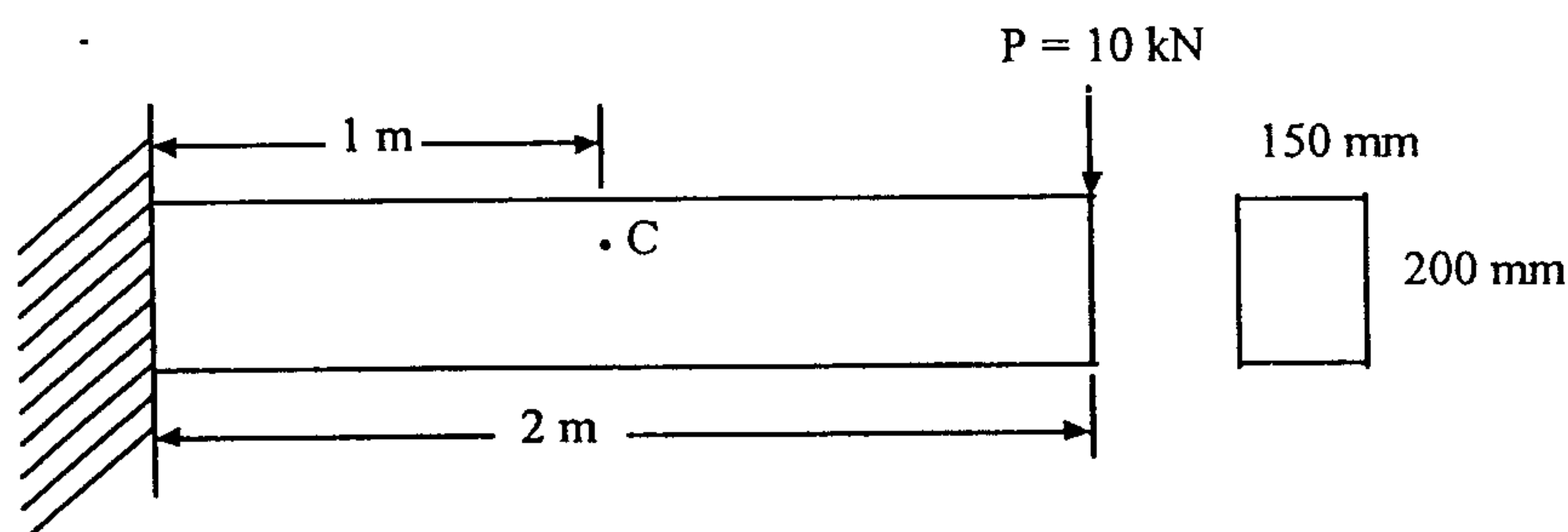
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4. A 60° strain-gage rosette (or delta rosette) is mounted on the outside of a cylindrical compressed air tank (see figure). The recorded strains are $\varepsilon_A = 40 \times 10^{-6}$ and $\varepsilon_B = \varepsilon_C = 137.5 \times 10^{-6}$. If the diameter of the tank is 1 m, the thickness of the wall is 40 mm, the modulus of elasticity is 200 GPa, and the Poisson's ratio is 0.3, what is the air pressure in the tank? (15%)



5. A cantilever beam of length $L = 2$ m supports a load of $P = 10$ kN (see figure). The cross-sectional dimensions of the beam are 150 mm \times 200 mm. Determine the principal stresses at point C located 50 mm from the top surface of the beam. (15%)



6. A cantilever beam AB of length L has a fixed support at A and a roller support at B (see figure). The support at B is moved downward through a distance δ . Determine the reactions of the beam, the equations of slope and deflection curve in terms of the imposed displacement δ . (15%)

