國立中央大學103學年度碩士班考試入學試題卷

所別：機械工程學系碩士班 甲組(固力與設計)(一般生)　科目：材料力學　共 1 頁 第 1 頁
機械工程學系光機電工程碩士班 乙組(光機)(一般生)

本科考試可使用計算器，廠牌、功能不拘　　＊請在試卷答案卷（卡）內作答

1. As shown in **Fig. 1**, the shaft has a length L and is formed of two materials, an outer tube of steel (Young's modulus E_s, shear modulus G_s) and an inner bar of brass (Young's modulus E_b, shear modulus G_b). The steel tube has an outer diameter d_1 and inner diameter d_2, and the brass bar has a diameter d_3. The shaft is held rigidly at end A and welded to a steel plate at B. (a) If a torque T is applied to the rigid plate, what is the angle of rotation ϕ of the plate? (b) What is the torsional stiffness k of the device? (c) If a load P is applied to the rigid plate, what is the displacement δ of the plate? **(25%)**

2. As shown in **Fig. 2**, (a) draw the shear and moment diagrams for the T-beam; (b) determine the maximum shear stress at the critical section where the internal shear force is maximum. **(25%)**

3. A shown in **Fig. 3**, the beam is fixed at end A and supported by vertical rollers at B (the rollers allow vertical deflection but prevent rotation). Two concentrated loads of a magnitude of P are applied at the midsection of the beam and at B, respectively. Determine all the support reactions at ends A and B. The beam has a flexural rigidity of EI. **(25%)**

4. A 50-mm-diameter rod is subjected to the loads shown in **Fig. 4**. Neglect the weight of the rod. Determine (a) the state of stress at point A; (b) the principal stresses acting at point A; (c) the state of stress at point B; (d) the maximum in-plane shear stress at point B. Please show the results on the corresponding differential elements for the above questions. **(25%)**

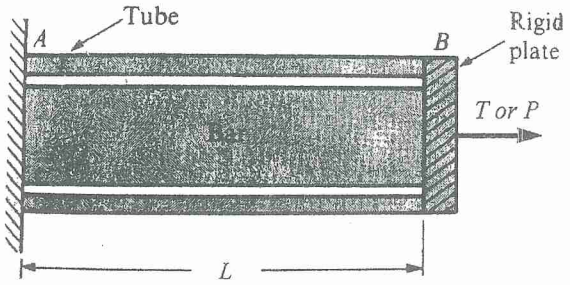
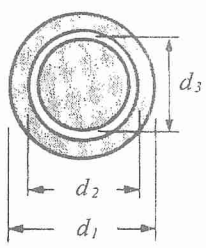


Fig. 1



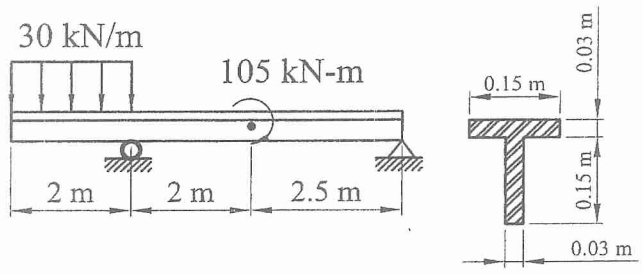


Fig. 2

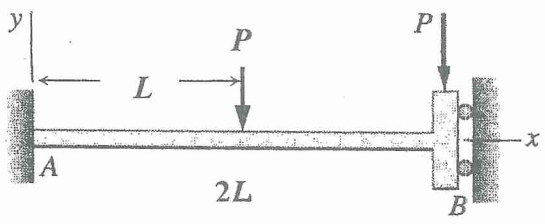


Fig. 3

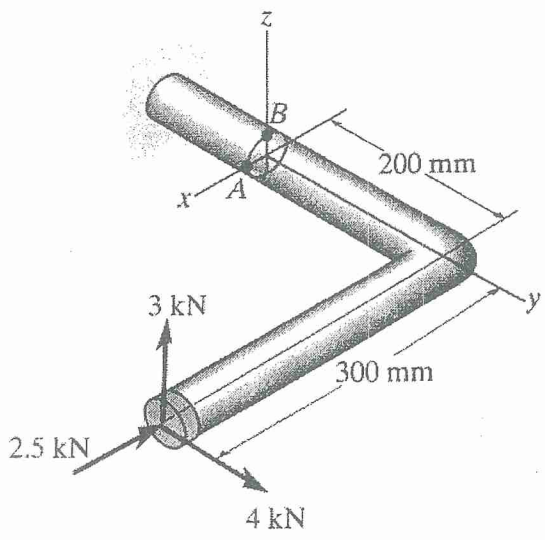


Fig. 4