國立中央大學100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 / 頁 第 / 頁
生物醫學工程研究所碩士班 甲組(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. A shaft and tube compact system is designed as shown in **Fig. 1** where the surface *A* is fixed. The outer tube is made of steel with a shear modulus of $G = 75$ GPa and the inner rod is made of aluminum with a shear modulus of $G = 25$ GPa. If the maximum allowable shear stress is $\tau_{allow} = (500/17\pi)$ MPa. Please determine (a) the maximum torque *T* that can be applied at surface *C*; (b) with this maximum applied torque, what is the twisted angle at the end surface *B*; and (c) the maximum shear stress at the surface *C*. (Points will be given **only if** using free body diagram to analyze the problem). **(25%)**

2. As shown in **Fig. 2**, the square wood is used as a railroad tie. It carries two uniformly distributed loads, each totaling 48 kN. The reaction from the ground is uniformly distributed over the length of the tie. Determine the smallest allowable dimension *b* of the cross section if the maximum allowable bending stress is 10 MPa and the maximum allowable shear stress is 1.2 MPa in the wood tie. **(25%)**

3. As shown in **Fig. 3**, a hydraulic jack can be used to rise point *B* of the cantilever beam *ABC*. The beam was originally straight, horizontal, and unloaded. A 20 kN load was then applied at point *C*, causing this point to move down. Determine the final value of the reaction at *B*. **(25%)**

4. As shown in **Fig. 4**, the solid rod is fixed at one end and has two 90° bends. A horizontal force *F* is applied at the other end, and the radius of the cross section is 10 mm. If the maximum allowable shear stress of the rod is 160 MPa and a safety factor of 2.0 is considered, determine the maximum safe value of the horizontal force *F*. Ignore the stress concentration at the bends and the weight of the rod. **(25%)**

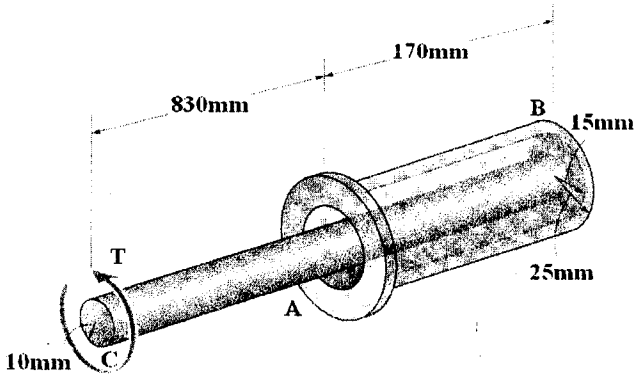

Fig. 1

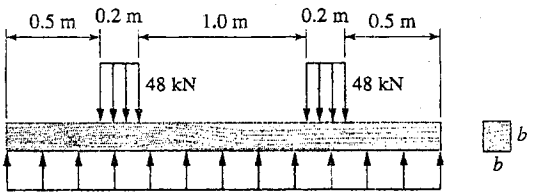

Fig. 2

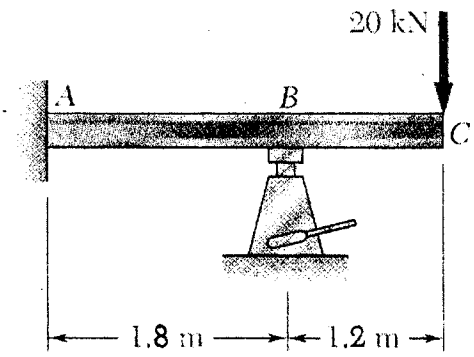

Fig. 3

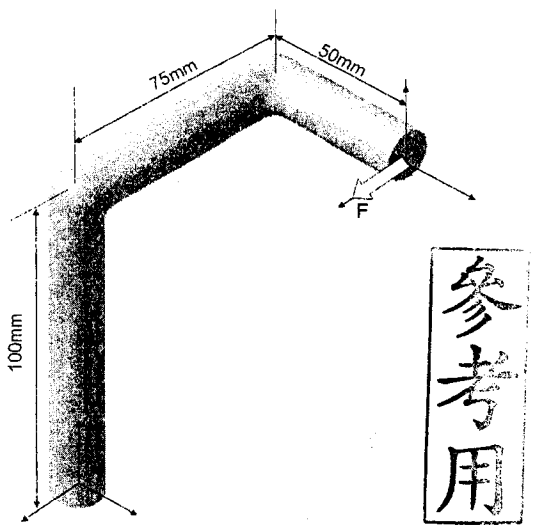

Fig. 4

參考用