國立中央大學八十八學年度碩士班研究生入學試題卷

所別: 機械工程研究所 乙組 科目: 機械材料及材料力學 共 2 頁 第 1 頁

一.(25%)

(1)金屬材料具有哪些特性?爲什麼?(5%)

(2)陶瓷材料具有哪些特性?爲什麼?(5%)

(3)硬度測試金屬材料時,須要注意哪些事項?(5%)

(4)請簡短描述析出強化理論與加工強化理論(5%)

(5)哪些因素會影響固體材料擴散(Diffusion)特性?爲什麼? (5%)

二.(25%)

(1)On the basis of the atomic bonding, answer the following questions:

(a) Explain the anomalous behavior of water when it freezes. That is, why is there volume expansion upon solidification. (5%)

(b) Would you expect a material in which the atomic bonding is predominantly ionic in nature to be more or less likely to form a noncrystalline solid upon solidificxation than a covalent material? Why? (5%)

(2)On basis of crystalline structure, answer the following questions:

(a) Compute the planar densities of the (100) and (111) planes for FCC; compute the linear density of the [100], [110] and [111] directions for FCC. (10%)

(b) How many slip systems does a FCC have along the 〈110〉 directions within the {111} planes? Show them schematically. (5%)

三.(25%)

(1) A circular bar in torsion consists of two parts, as shown in Fig. 1. One part has diameter $d_1 = 2.0$ in. and length $L_1 = 50$ in., and the other part has diameter $d_2 = 1.5$ in. and length $L_2 = 50$ in. What is allowable torque T if the angle of twist between the ends of the bar is not to exceed 0.02 radians and the shear stress is not to exceed 4000 psi? (Assume $G = 12 \times 10^6$ psi.) (8%)

(2) Construct the shear–force and bending-moment diagrams for the beam shown in Fig. 2. (8%)

(3) A beam ABC supports a concentrated load P = 4.0 kN at the end of the overhang (see Fig. 3). The cross section of the beam is T-shaped with dimensions as shown. Calculate the maximum tensile stress σ_t and maximum compressive stress σ_c due to the load P. (9%)

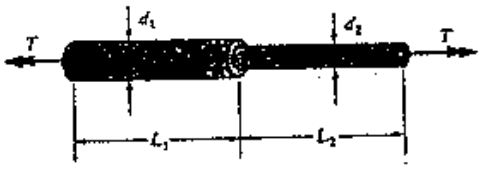


Fig. 1

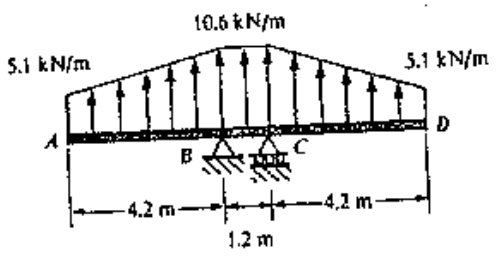


Fig. 2

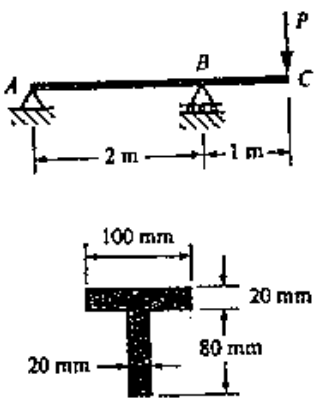


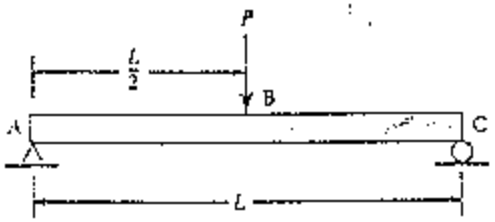
Fig. 3

四. (25%)

(1) For the simply supported rectangular beam, as shown below, subjected to a concentrated load P at midspan, determine the deflection at midspan B. Consider only deflection due to bending. Let EI be constant

(a) *Use the work-energy principle.* (10%)

(b) *Use Castigliano's theorem.* (10%)



(2) A circular cylinder pressure vessel is subjected to an internal pressure of $p = 1.8MPa$ (see the figure). The vessel has inside radius $r_i = 0.75m$. The working or allowable stress is $90MPa$. Determine the required wall thickness of the vessel.