國立中央大學八十六學年度碩士班研究生入學試題卷

1. A load P will be supported by a structure consisting of rigid bar A, two aluminum alloy bars B (E = 10600 ksi), and a stainless steel bar C (E = 28000 ksi), as shown in Fig. 1. The bars are unstressed when the structure is assembled at room temperature (72 °F). Each bar has a cross-sectional area of 2.00 in^2. The coefficients of thermal expansion are $12.5(10^{-6})$/°F for the aluminum and $9.6(10^{-6})$ /°F for the stainless steel. Determine the axial stresses in the bars after a 40-kip load is applied and the temperature is increased to 250 °F. **(25%)**

2. A group of wooden beams is used as a dam as shown in Fig. 2. To what thickness t of the beams can the water be raised if the maximum bending stress σ_{max} is not to exceed 15 MPa? Take h = 3.253 m, and the weight of the water is 9.81 kN/m^3. **(25%)**

3. For the statically indeterminate beam as shown in Fig. 3. Please find
(a) the reactions. **(8%)**
(b) the deflection relation. **(9%)**
(c) the maximum deflection. **(8%)**
where E, I are material constants, w is the uniform distributed load.

4. Fig. 4 shows a small pressurized cylinder, attached at the one end and loaded with a pipe wrench at the other. The internal pressure causes a tangential stress of 200 MPa and an axial stress of 100 MPa that act on an element at point A. The pipe wrench superimposes a bending stress of 50 MPa and a torsional stress of 100 MPa.
(a) Make a Mohr circle representation of the state of stress at point A. **(5%)**
(b) Determine the principal stresses and maximum shear stress at point A. **(9%)**
(c) Make a sketch showing the orientation of a principal element (with respect to the original element drawn at A), and show all stresses acting on it. **(6%)**
(d) Determine the corresponding principal strains and maximum shear strain at point A if Young's modulus is E = 70 GPa and Poisson's ratio is ν = 0.3. **(5%)**

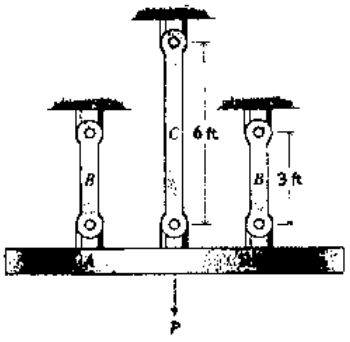

Fig. 1

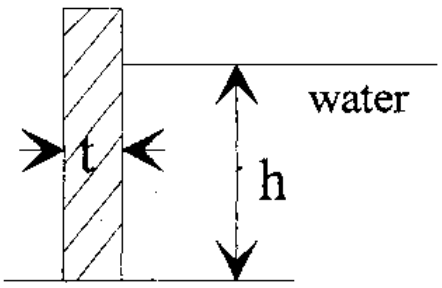

Fig. 2

參考用

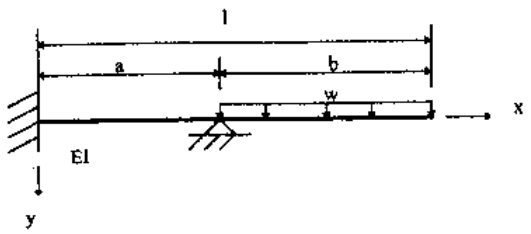

Fig. 3

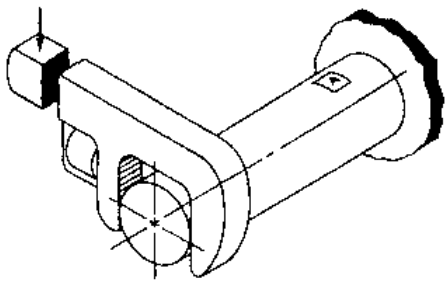

Fig. 4