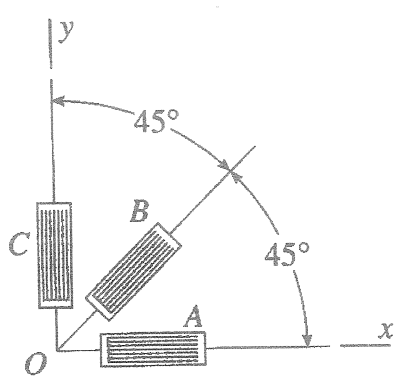
國　立　清　華　大　學　命　題　紙

97 學年度 動力機械工程學系(0511) （所） 丙 組碩士班入學考試

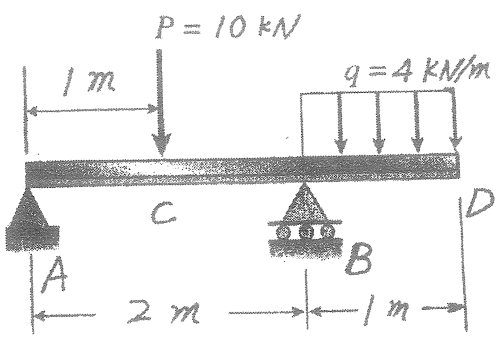
科目 材料力學 科目代碼 1101 共 3 頁第 1 頁 *請在【答案卷卡】內作答

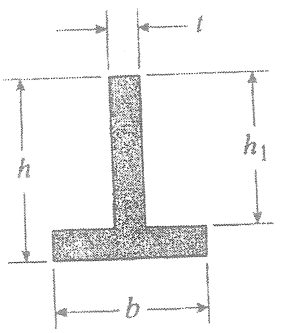
1. Explain the following terms. (25%, 5% each)
   (a) dilatation
   (b) plane strain
   (c) bulk modulus of elasticity
   (d) fully stressed beam
   (e) slenderness ratio of a column

2. A 45° strain rosette mounted on the surface of an automobile frame gives the following readings: gage $A$, $600 \times 10^{-6}$; gage $B$, $300 \times 10^{-6}$; and gage $C$, $-100 \times 10^{-6}$. (a) Find the state of strain from the strain gage readings. (b) Determine the principal strains, the principal angles and the maximum shear strains. (15%)

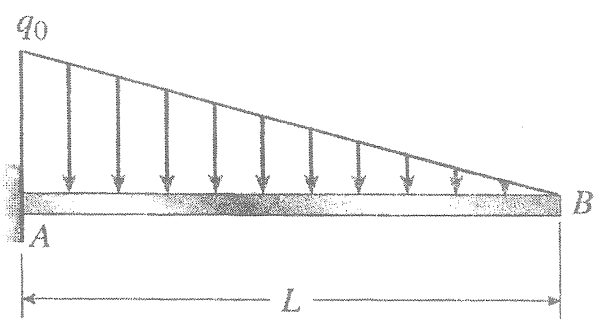


3. Beam *ACBD* has a *T* section subjected to a concentrated and distributed load as shown. Determine the maximum tensile stress $\sigma_t$ and maximum compressive stress $\sigma_c$ of the beam. The dimensions of the section are as follows: $b = 90$ mm, $h = 120$ mm, $t = 30$ mm and $h_1 = 90$ mm. (15%)

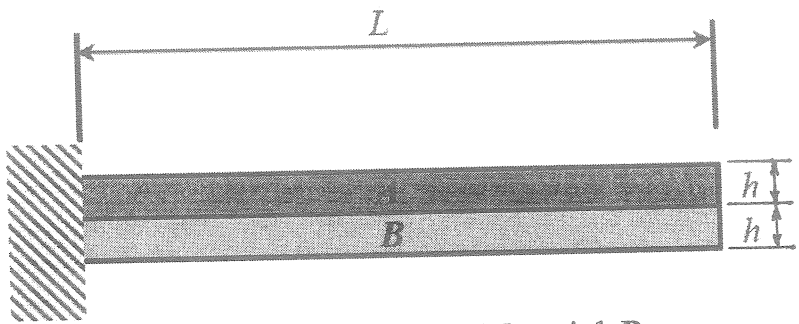



4. The cantilever beam of flexural rigidity *EI* and length *L* subjected to a triangularly distributed load of maximum intensity $q_0$ as shown. Determine the slope and deflection at the free end *B* by using Casigliano's theorem. (15%)



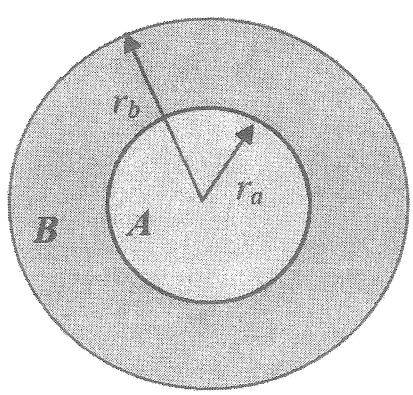
5. Figure below shows the model for a thermostat which consists of two firmly bonded materials ***A*** and ***B***. Determine the deflection at the free end of the cantilever due to a temperature rise $T$. (15 %)




Material ***A***
Young's modulus: $E_a$
Thermal expansion coefficient: $\alpha_a$
Moment of inertia: $I$
Thickness: $h$

Material ***B***
Young's modulus: $E_b$
Thermal expansion coefficient: $\alpha_b$
Moment of inertia: $I$
Thickness: $h$

6. A circular composite bar is consisted of a hollow tube ***B*** and a solid core ***A***. The hollow tube ***B*** is firmly bonded with the solid core ***A***. (a) Express the polar moment of inertia $J_a$ and $J_b$ as function of radius $r_a$ and $r_b$, (b) Determine formulas for the maximum shear stresses $\tau_a$ (in ***A***) and $\tau_b$ (in ***B***) when the composite bar is subjected to a torque $T$. (15 %)




Solid Core ***A***
Shear modulus: $G_a$
Polar moment of inertia: $J_a$

Hollow Tube ***B***
Shear modulus: $G_b$
Polar moment of inertia: $J_b$