

九十二學年度 動力機械 系(所) 丙 組碩士班研究生招生考試

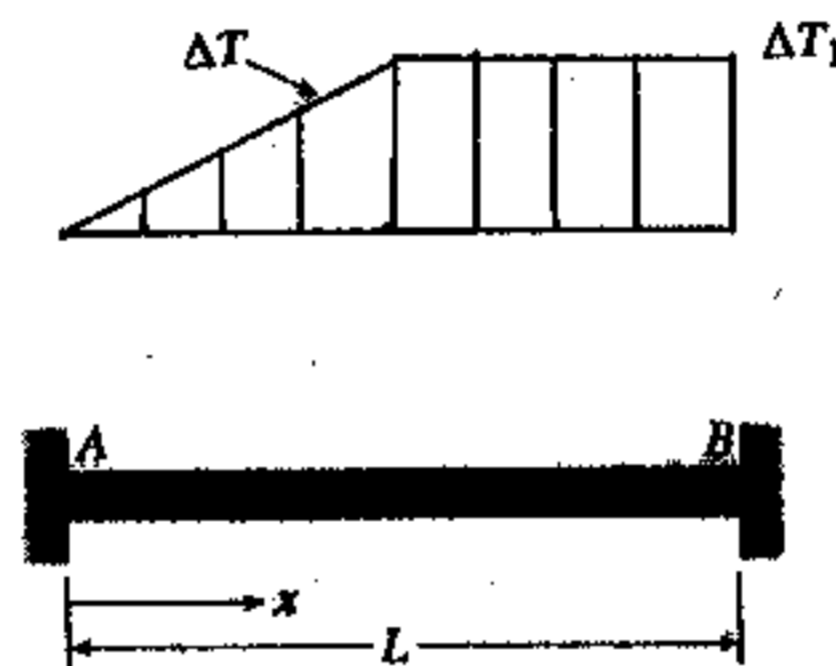
科目 材料力學 科號 1501 共 3 頁第 1 頁 *請在試卷【答案卷】內作答

1. A bar AB of length L is held between rigid supports and heated nonuniformly in such a manner that the temperature increase ΔT at distance x from end A is given by the expression

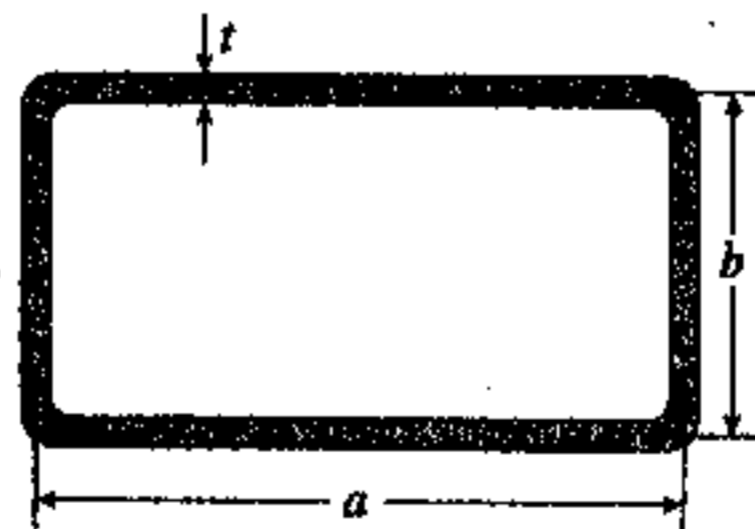
$$\Delta T = 2 \Delta T_1 x / L \quad \text{for } x = 0 \sim L/2$$

$$\Delta T = \Delta T_1 = \text{constant} \quad \text{for } x = L/2 \sim L$$

Determine the compressive stress σ_c in the bar. Assume that the material has modulus of elasticity E and coefficient of thermal expansion α . (15%)



2. A thin-walled rectangular tube has uniform thickness t and dimensions $a \times b$ to the median line of the cross section. How does the shear stress in the tube if the total length L_m of the median line of the cross section and the torque T remain constant? Also show that the shear stress is smallest when the tube is square, that is $\beta = 1$. (15%)



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3. The state of strain at point A on the bracket in Figure 3-a is measured using the strain rosette shown in figure 3-b. Due to the loading, the reading from the gauges give $\epsilon_a = 60E-6$, $\epsilon_b = 135E-6$ and $\epsilon_c = 264E-6$. Determine the in-plane principal strains at the point and the direction in which they act. (20 %)

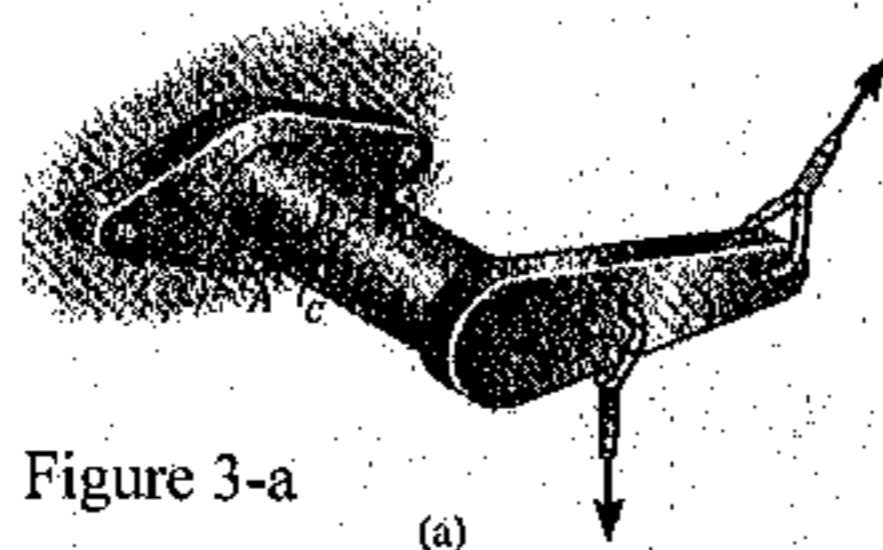


Figure 3-a

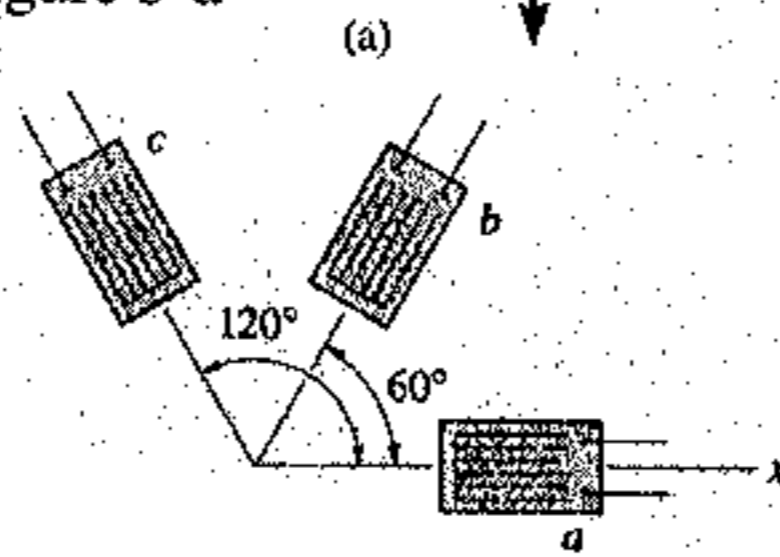


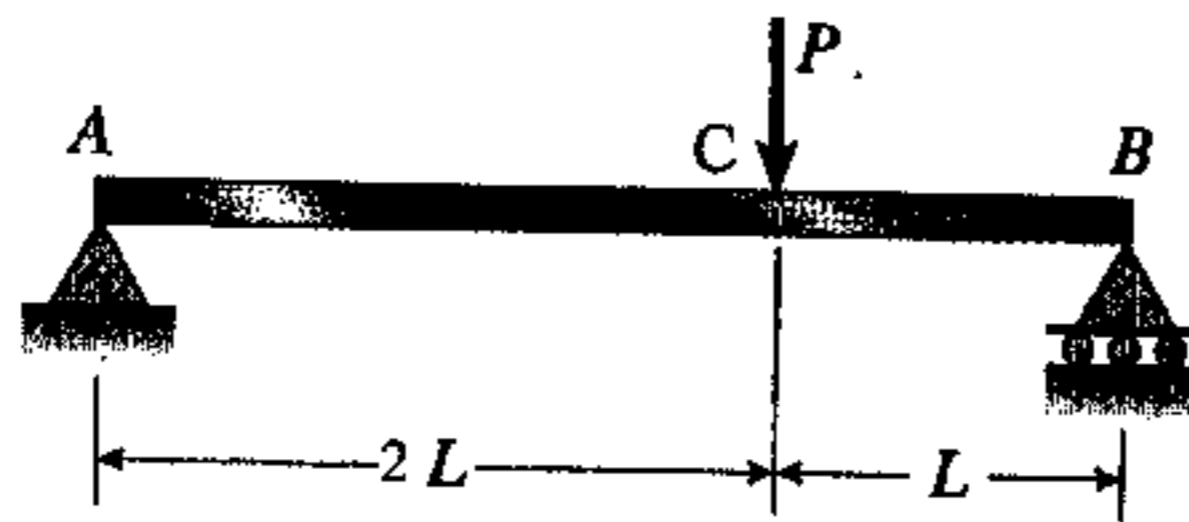
Figure 3-b

4. The state of plane strain at a point represented by the components $\epsilon_x = 250E-6$, $\epsilon_y = -150E-6$, and $\gamma_{xy} = 120E-6$. Determine the principal strains and the orientation of the element. (15%)

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5. The simple beam, with constant flexural rigidity EI , supports a concentrated load P acting at distance $2L$ from the left-hand support and distance L from the right-hand support. Obtain the solution by determining the strain energy of the beam and then using Castigliano's theorem to find the deflection δ_c at point C where the load is applied. (15%)



6. A propped cantilever beam AB of length L , with constant flexural rigidity EI , is loaded by a counterclockwise moment $2M_0$ acting at right-hand support B .
- Determine all the reactions at supports A and B .
 - Determine the deflection curve of the beam AB .
- Note: you may begin with the second-order differential equation of the deflection curve (the bending-moment equation) of this statically indeterminate beam to solve the problem.

(20%)

