

國立中央大學 109 學年度碩士班考試入學試題

所別： 機械工程學系 碩士班 固力與設計組(一般生)

共 3 頁 第 1 頁

機械工程學系光機電工程 碩士班 光機組(一般生)

科目： 材料力學

\*計算題需計算過程，無計算過程者不予計分

本科考試可使用計算器，廠牌、功能不拘

\*請在答案卷(卡)內作答

1. Each member of the truss has a uniform cross-sectional area  $A$  and a constant Young's modulus  $E$ . The original lengths of [1] and [2] are  $L$ , while the original length of [3] is  $\sqrt{2}L$ . Assume each member is pin connected. This simply supported truss shown in **Figure 1** is subjected to the change in temperature of the member. For example, the temperature of [1] is changed by  $-\Delta T$ . In addition, the temperatures of [2] and [3] are changed by  $+2\Delta T$  and  $+3\Delta T$ , respectively.
- Determine the force in each member of the truss. (6%)
  - Determine the deformation in each member of the truss. (9%)
  - Determine the displacements at points  $b$  and  $c$ . (10%)

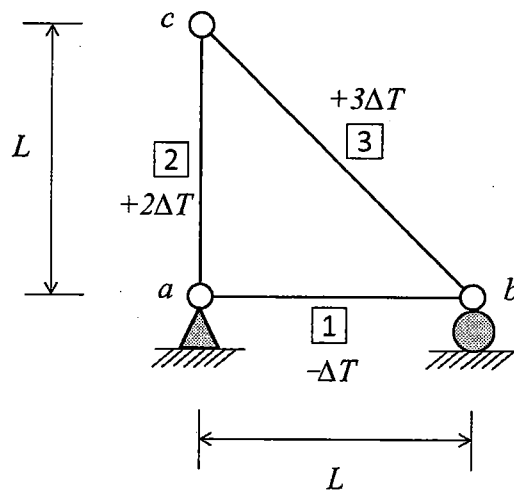


Figure 1

參考用

注意：背面有試題

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2.

(a)如圖 2-a 所示之兩個扳手(wrenches)被應用於鎖緊管子。已知管子的外徑為 25 mm (毫米)，內徑為 20 mm (毫米)。如果管子材料的允許剪切應力(allowable shear stress)和容許彎曲應力(allowable bending stress)分別為  $\tau_{allow} = 85\text{MPa}$  及  $\sigma_{allow} = 15\text{MPa}$ ，試決定每個扳手能對管子的施力( $P$ )應為若干？ (10%)

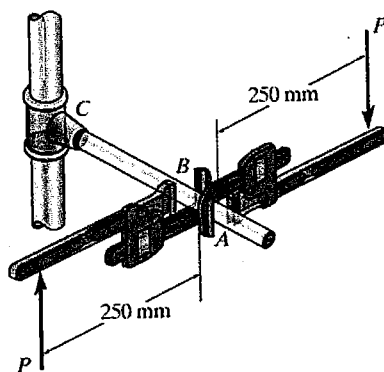


圖 2-a

(b)如圖 2-b 所示，如果木樑在 A 和 B 處的承載墊僅支撐垂直力，試決定可施加於木樑的最大力( $P$ )應為多少。已知木樑的容許剪切應力(allowable shear stress)和容許彎曲應力(allowable bending stress)分別為  $\tau_{allow} = 1.5\text{MPa}$  及  $\sigma_{allow} = 15\text{MPa}$ 。 (15%)

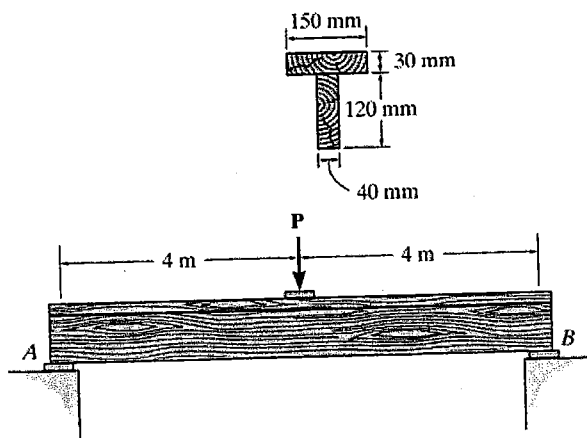


圖 2-b

參考

注意：背面有試題

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3. A beam  $ABC$  with simple supports at  $A$  and  $B$  and an overhang from  $B$  to  $C$  (Fig. 3) supports a uniform load  $q = 15 \text{ kN/m}$  over part of the span and a concentrated load  $P = 14 \text{ kN}$  at the free end. (a) Write the expression for the intensity  $q(x)$  of the equivalent distributed loads acting on the beam. (b) Find the deflection  $\delta_c$  at the end of the overhang. (25%)

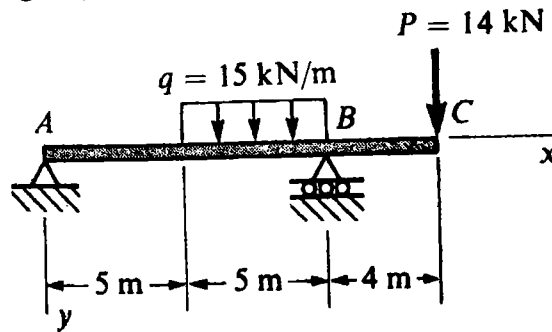


Figure 3

4. As shown in Figure 4, a circular solid shaft of diameter  $d$  is fixed at one end and is subjected to a bending moment  $M$ , a torque  $T$ , and an axial force  $P$  at the other end.
- (a) Determine the maximum normal stress and maximum shear stress developed anywhere in the shaft as a function  $d$ ,  $M$ ,  $T$ , and  $P$ . Please also show the corresponding location on the shaft for these stresses with a sketch of properly oriented elements in reference to the axial direction of the shaft. (15%)
- (b) If  $M = 1 \text{ kN}\cdot\text{m}$ ,  $T = 1.5 \text{ kN}\cdot\text{m}$ , and  $P = 0$ , what is the minimum shaft diameter  $d$  required for an allowable normal stress of 80 MPa and an allowable shear stress of 60 MPa? (10%)

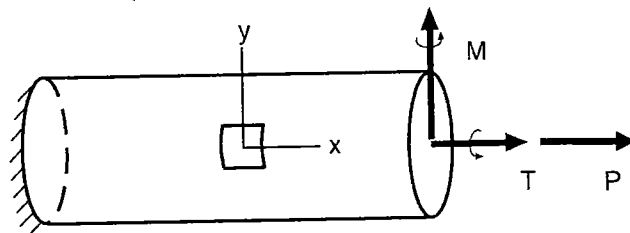


Figure 4

參考用