

國立虎尾科技大學 103 學年度第一學期博士班資格考試題

所別：動力機械系機械與機電工程博士班

第一頁 共二頁

科目：材料力學

注意事項：

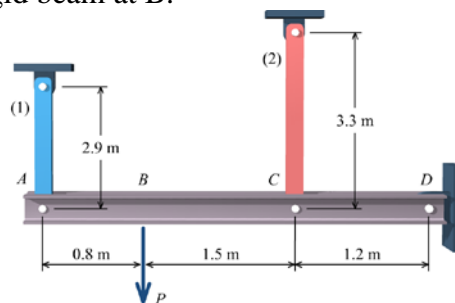
- (1) 本試題共有 5 題，每題 20 分，合計一百分。
- (2) 請依序作答於答案卷上並註明題號，若未註明選答題號及超過規定題數時，謹採計作答順序較前之題目計分。
- (3) 可使用計算機，close book

1. Explain the meanings of following terminologies:

- (a) Generalized Hooke's law
- (b) Saint-Venant's principle
- (c) Neutral axis
- (d) Stress-strain curve

2. The pin-connected structure shown in figure consists of a rigid beam ABCD and two supporting bars. Bar (1) is an aluminum alloy [$E = 70 \text{ GPa}$] with a cross-sectional area of $A_1 = 2,400 \text{ mm}^2$. Bar (2) is a bronze alloy [$E = 100 \text{ GPa}$] with a cross-sectional area of $A_2 = 6,000 \text{ mm}^2$. The normal stress in the aluminum bar must be limited to 70 MPa , and the normal stress in the bronze rod must be limited to 90 MPa . Determine:

- (a) the maximum downward load P that may be applied at B.
- (b) the deflection of the rigid beam at B.



3. A wooden box beam is fabricated from four boards, which are fastened together with nails, as shown in Fig. a. The nails are installed at a spacing of $s = 125 \text{ mm}$ (Fig. b), and each nail can provide a resistance of $V_f = 500 \text{ N}$. In service, the box beam will be installed so that bending occurs about the z axis. Determine the maximum shear force V that can be supported by the box beam based on the shear capacity of the nailed connections.

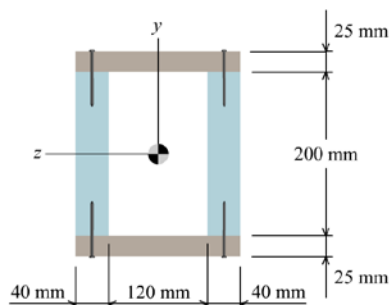


Fig. a

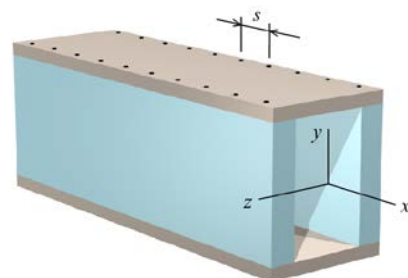


Fig. b

國立虎尾科技大學 103 學年度第一學期博士班資格考試題

所別：動力機械系機械與機電工程博士班

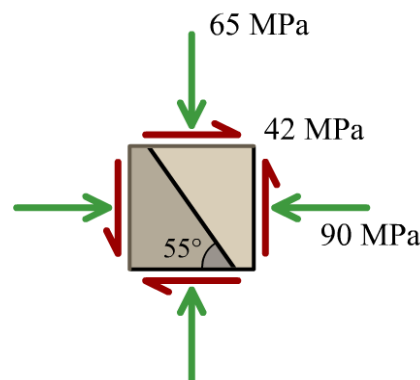
第二頁 共二頁

科目：材料力學

注意事項：

- (1) 本試題共有 5 題，每題 20 分，合計一百分。
- (2) 請依序作答於答案卷上並註明題號，若未註明選答題號及超過規定題數時，謹採計作答順序較前之題目計分。
- (3) 可使用計算機，close book

4. Consider a point in a structural member that is subjected to plane stress. Normal and shear stresses acting on horizontal and vertical planes at the point are shown.
- (a) Draw Mohr's circle for this state of stress.
 - (b) Determine the principal stresses and the maximum in-plane shear stress acting at the point. Show these stresses on an appropriate sketch.
 - (c) Determine the normal and shear stresses on the indicated plane and show these stresses on a sketch.
 - (d) Determine the absolute maximum shear stress at the point.



5. On the free surface of an aluminum [$E = 70 \text{ GPa}$; $\nu = 0.35$] component, the strain rosette shown in figure was used to obtain the following normal strain data: $\epsilon_a = 980 \times 10^{-6}$, $\epsilon_b = 870 \times 10^{-6}$, and $\epsilon_c = 400 \times 10^{-6}$. Determine the normal stress that acts along an axis that is rotated at an angle of $\theta = 20^\circ$ below the positive x axis.

