編號： 108

國立成功大學 105 學年度碩士班招生考試試題

系　　所：土木工程學系

考試科目：材料力學

考試日期：0227，節次：1

※ 考生請注意：本試題不可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. For the bent thin-walled circular pipe ABC shown in Fig. 1, (a) draw the shear flow in the cross section located in pipe BC and indicate its variation. Also show that the maximum shear stress is equal to two times the average shear stress (10%); (b) Draw the shear flow in the cross section located in pipe AB and indicate its variation. Also find the maximum shear stress in pipe AB. (10%)

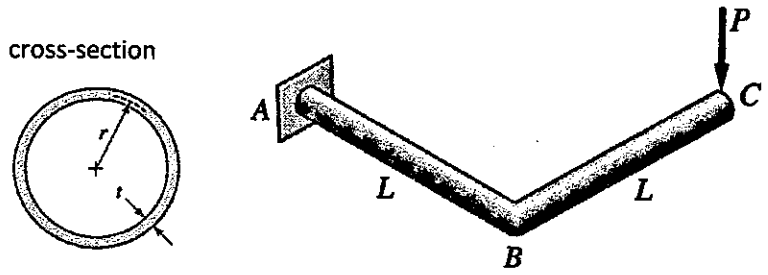

Fig. 1

2. For a plane element *abcd* subjected to pure shear τ (see Fig. 2(a)), (a) derive the strain along diagonal direction *bd* in terms of shear modulus G. (10%) ; (b) find the stress state when the element is oriented at 45° (see Fig. 2(b)) and show it on the oriented element. Also derive the normal strain along *a'b'* in terms of Young's modulus E and Poisson's ratio ν. Also use the answer in (a) to show the relation $G = \frac{E}{2(1+\nu)}$. (10%)

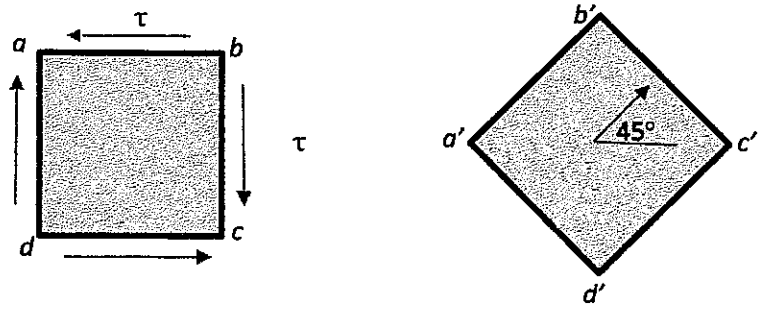

Fig. 2　　(a)　　(b)

3. Figure 3 shows the shear force diagram on a beam. Find the value of force Q (in terms of P) and draw the loads and bending moment diagram that correspond to Figure 3. Assume that no couple is applied. (20%)

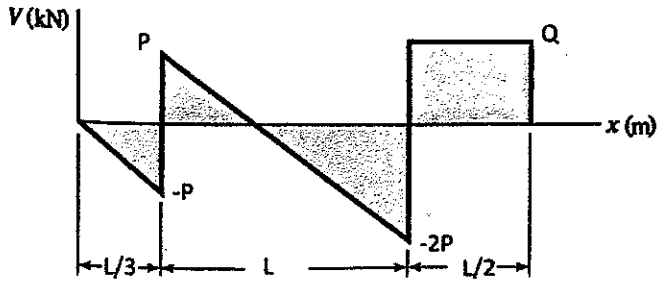

Fig.3

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4. A composite beam section is bonded by one T-shaped steel and two brass pieces, shown in Fig 4. Knowing that the ratio of moduli in two materials is $E_s/E_b = 2$.

   (a) Find the location *d* of the neutral axis of the composite section. (10%) (in terms of t (mm))

   (b) If the allowable stresses in steel and in brass are 200 MPa and 100 MPa, respectively, determine the maximum bending moment about the neutral axis? (10%) (in terms of t (mm))

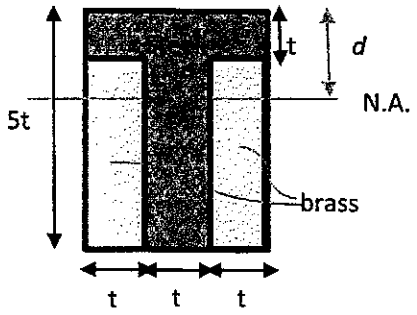
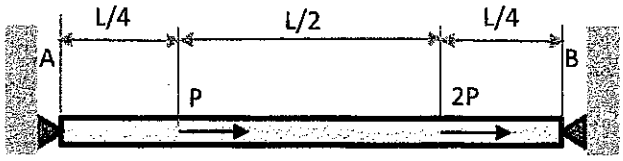


Fig. 4

5. A rod AB of Young's modulus E and cross sectional area A is hinged to the walls at ends A and B. It is initially at stress-free state. (a) When rod AB is subjected to loads as shown in Fig. 5(a), determine the reactions at two ends. (10%) (b) The rod AB is subjected to a non-uniform temperature increase, which has the maximum value ΔT_o at the midpoint C and varies linearly along the rod axis to zero at ends A and B, as shown in Fig. 5(b). Determine the reactions at two ends, and the value of ΔT_o that could cause the buckling of the rod. (10%)

(a)



(b)

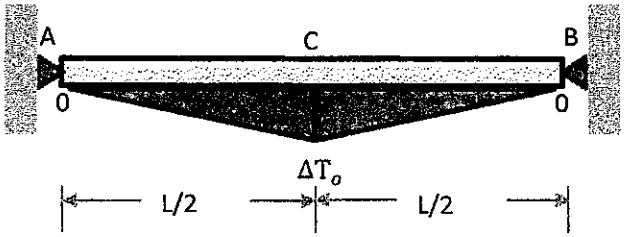


Fig. 5