

國立臺灣科技大學

115學年度碩士班招生

試題

系所組別：0310機械工程系碩士班甲組

科 目：材料力學

<<503102>>



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(總分為100分;所有試題務必於答案卷內頁依序作答)

1. (15%) Fig. 1 shows a steel pipe of length $L = 800\text{mm}$, outside diameter $d_1 = 200\text{mm}$, and inside diameter $d_2 = 150\text{mm}$ is compressed by an axial force $P = 600\text{kN}$. The material has modulus of elasticity $E = 210\text{ GPa}$ and Poisson's ratio $\nu = 0.3$. Determine the following quantities for the pipe:
- (1) (5%) the deformation δ
 - (2) (5%) the lateral strain ϵ'
 - (3) (5%) the increase in the wall thickness Δt

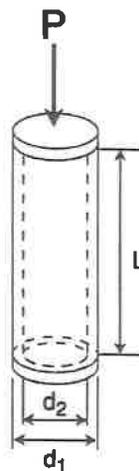


Fig. 1

2. (15%) A rigid beam $ABCD$ is supported by bar (I) and (II) as shown in the Fig. 2. Assume that there is no strain in the vertical bars before load P is applied. After load P is applied, the normal strain in rod (I) is -6×10^{-4} .
- (1) (5%) Determine the deformation δ_I of rod (I)
 - (2) (5%) Determine the deformation δ_{II} of rod (II)
 - (3) (5%) Determine the normal strain in rod (II)

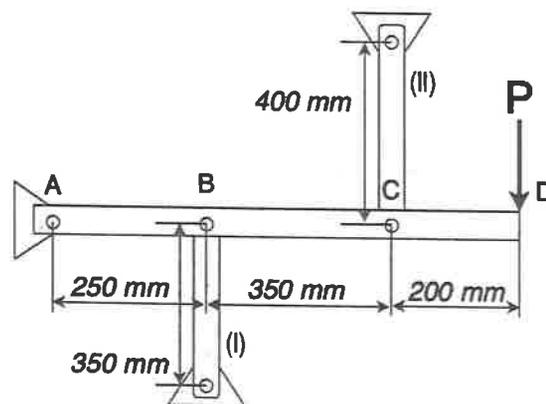


Fig. 2



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3. (20%) The beam has the rectangular cross section shown in Fig. 3. If the linear distributed load $w = 1 \text{ kN/m}$, determine
- (1) (10%) the reaction forces N_A and N_B
 - (2) (5%) the moment of inertia I_x
 - (3) (5%) the maximum bending stress in the beam.

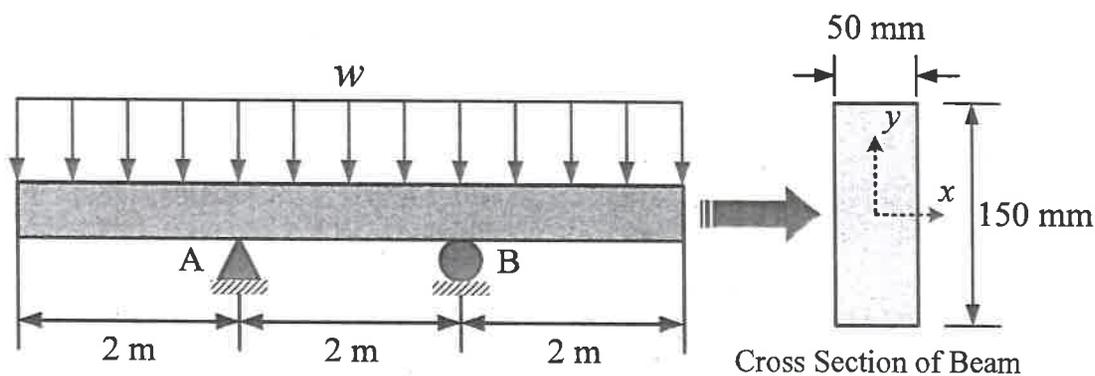


Fig. 3

4. (20%) The 50-mm-diameter A992 steel shaft (circular cross section) is subjected to the torques shown in Fig. 4. The shear modulus $G = 75 \text{ GPa}$, find
- (1) (10%) the torques T_{AD} and T_{BC} in this shaft.
 - (2) (5%) the polar moment of inertia J of this shaft.
 - (3) (5%) the angle of twist of the end A.

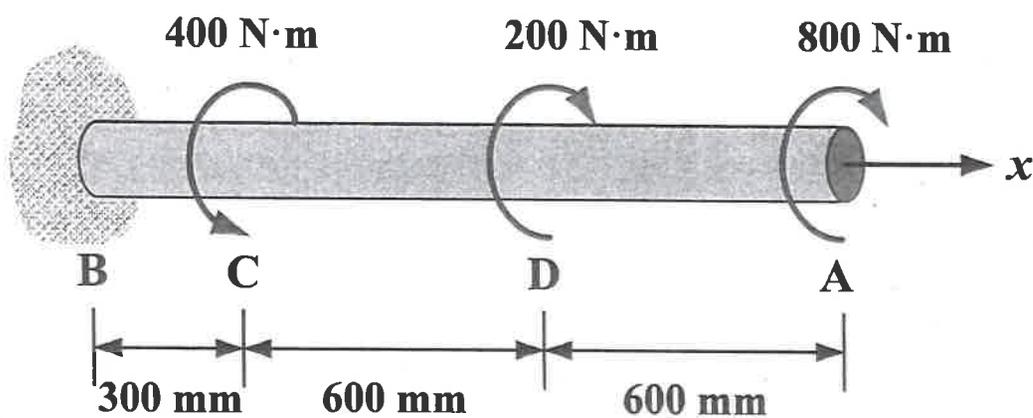


Fig. 4



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5. (30%) The state of plane stress is shown in Fig. 5, determine
- (15%) the principal stresses and the associated orientation angle.
 - (15%) the maximum in-plane shear stress, average normal stress, and the associated orientation angle.
- Notice the orientation angle is positive as the angle is *Counterclockwise*, negative as the angle is *Clockwise*

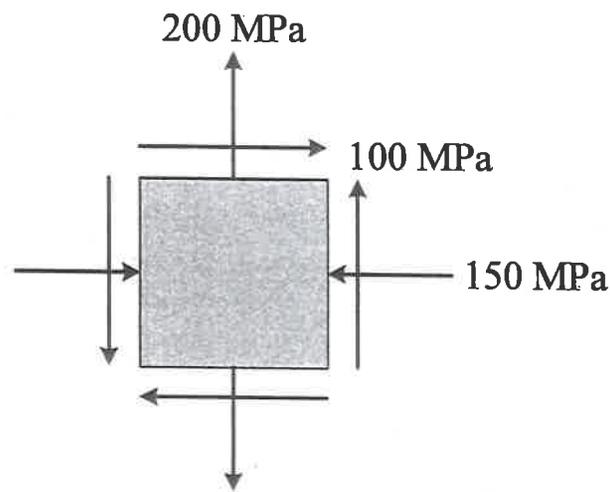


Fig. 5

