

國立中央大學八十八學年度碩士班研究生入學試題卷

所別： 機械工程研究所 甲組 科目： 材料力學 共 / 頁 第 / 頁

1. A long, thin plate of width b , thickness t , and length L is placed between two rigid walls with a distance b apart and is acted on by an axial force P , as shown in Fig. 1.
 - (a) We wish to find the deflection (δ_x) of the plate parallel to the force P . We also wish to find the component of normal strain in the thin direction (ϵ_z). (13%)
 - (b) If the thin plate held between two walls is heated from room temperature (25°C) to 325°C (the coefficient of thermal expansion is $\alpha/^\circ\text{C}$), and the axial force P acting as before, then what will the deflection δ_x and the normal strain ϵ_z become? (12%)

2. Three different materials with moduli E_1 , E_2 , and E_3 , respectively, are to be bonded to form a beam cross section as shown in Fig. 2. Develop expressions for (a) the bending stresses in each of the materials, and (b) the moment-curvature relationship. (25%)

3. (a) A cantilever beam is of uniform cross section and carries a load P at its free end as shown in Fig. 3. Determine the equation of the elastic curve and the deflection and slope at the free end. (15%)
- (b) The flexural rigidity is $2EI$ in portion AB of the beam and EI in portion BC as shown in Fig. 4. Determine the deflection at the free end. (10%)

4. A 12-mm-diameter drill bit is inserted into a chuck, as shown in Fig. 5. During the drilling operation, an axial force $P = 17.5\text{ kN}$ and a torque $T = 30\text{ N-m}$ act on the bit. If a horizontal force of 160 N is accidentally applied to the plate being drilled, what are the magnitudes of the largest principal stress and shear stress that develop at the top of the drill bit? Determine the critically stressed point on the drill by inspection. (25%)

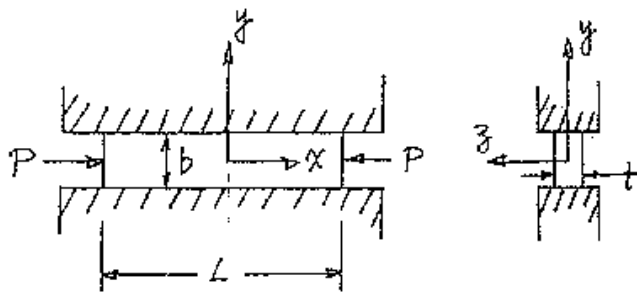


Fig. 1

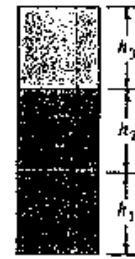


Fig. 2

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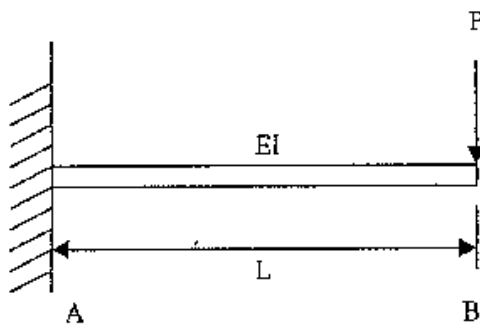


Fig. 3

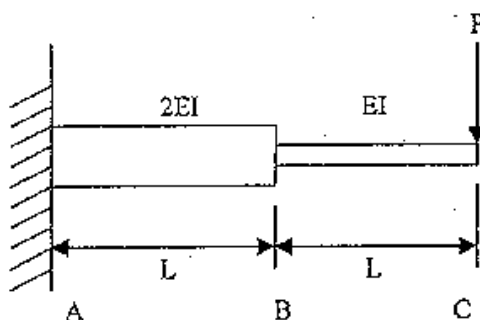


Fig. 4

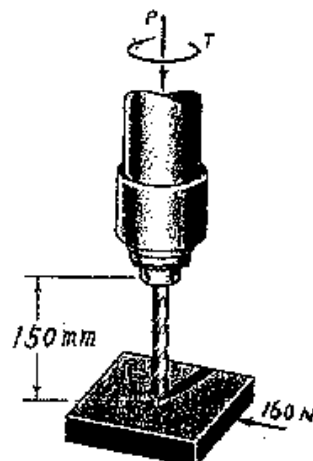


Fig. 5