

國立成功大學

115學年度碩士班招生考試試題

編 號：48

系 所：機械工程學系

科 目：材料力學

日 期：0203

節 次：第 1 節

注 意：1. 可使用計算機
2. 請於答案卷(卡)作答，於
試題上作答，不予計分。

Problem 1 (20 Pts)

As shown in Fig. 1, the post is fixed at its base (cantilever support), and the external loadings are applied at the free end (top end). Assuming the material remains linearly elastic and point A is under plane stress conditions, determine the following stresses at point A . (a) the maximum in-plane shear stress developed at A . (b) the principal stresses at A

Problem 2 (15 Pts)

The steel channel is used to reinforce the wooden beam, as illustrated in Fig. 2. If the composite beam is subjected to a bending moment of $M = 1200 \text{ lb}\cdot\text{ft}$, determine the maximum normal stress in the steel channel, and the maximum normal stress in the wood beam ($E_{st} = 29(10^3) \text{ ksi}$, $E_w = 1600 \text{ ksi}$).

Problem 3 (15 Pts)

Determine the shear center location e measured from a reference point O for the thin-walled cross-section shown in Fig. 3. All wall segments have uniform thickness t , and the member can be treated as thin-walled and open-section.

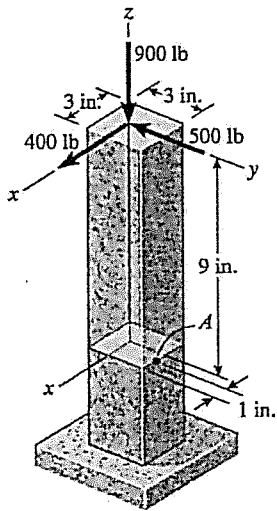


Fig. 1

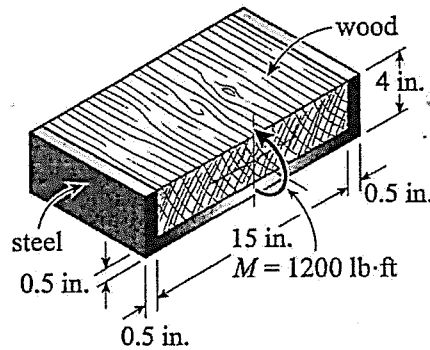


Fig. 2

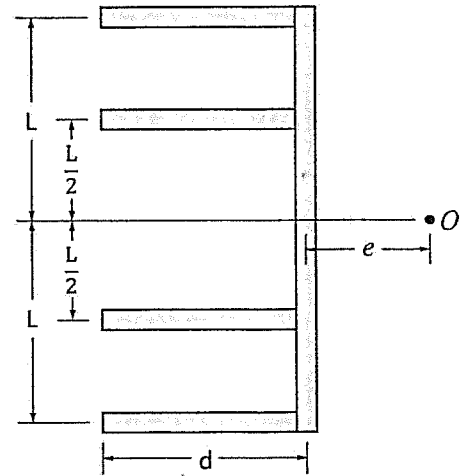


Fig. 3

Problem 4 (15 Pts)

A solder cube of length, width and thickness all being 5 mm is confined in the U-shaped slot of a smooth rigid block. The width of the slot is also 5 mm. The Young's modulus, yield stress, and Poisson's ratio of the solder cube are 25 GPa, 40 MPa, and 0.4, respectively. A compressive load P is applied uniformly on the top surface of the solder block. By using the maximum distortion energy theory, determine the load P required to cause plastic deformation of the solder cube.

Problem 5 (15 Pts)

The elastic-perfectly plastic rod with yield stress of 100 MPa, yield strain of 0.1%, and a diameter of 20 mm is supported by rigid walls at both ends. Under the applied axial load P , segment CB just yielded. Determine the elongation of the rod when both the load P and the supports are removed.

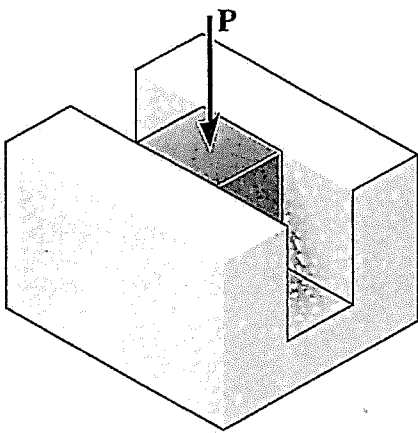


Fig. 4

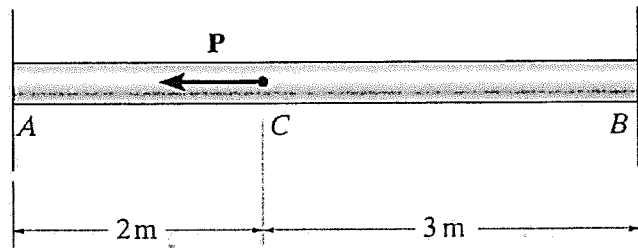


Fig. 5

Problem 6 (20 Pts)

A beam of constant EI is built-in to the wall at both ends A and B as shown in Fig. 6. Given that $a = 0.3L$, determine the maximum deflection of the beam by using Castigliano's theorem (alternative solution approach is not allowed).

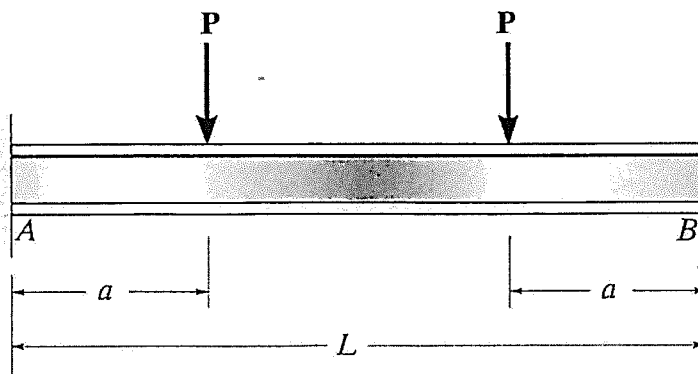


Fig. 6