國立嘉義大學 107 學年度
土木與水資源工程學系碩士班（甲組）招生考試試題

科目：材料力學

說明：1.如有條件不足，請自行做合理假設。

　　　2.僅可使用試務單位提供之計算機。

1. A punch for making holes in steel plates is shown in Fig.1a. Assume that a punch having diameter d=20mm is used to punch a hole in an 8mm plate, as shown in the cross-sectional view (Fig.1b). If a force P=110 kN is required to create the hole, what is the average shear stress in the plate and the average compressive stress in the punch? (20%)
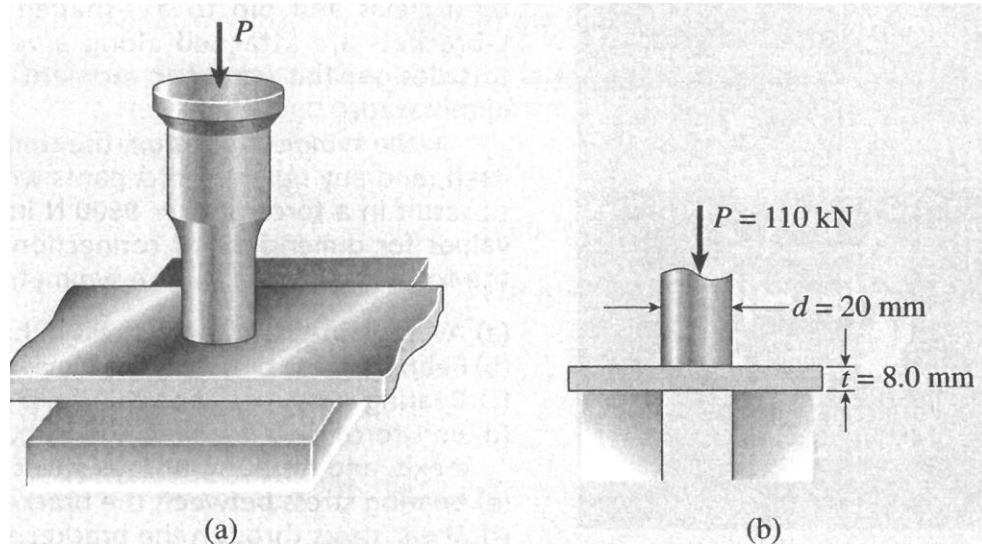

Fig. 1

2. A solid steel bar of circular cross section (Fig.2) has diameter d=40mm, length L=1.3m, and shear modulus of elasticity G=80 GPa. The bar is subjected to torques T acting at the ends. If the allowable shear stress is 42 MPa and the allowable angle of twist is 2.5°, what is the maximum permissible torque? (20%)
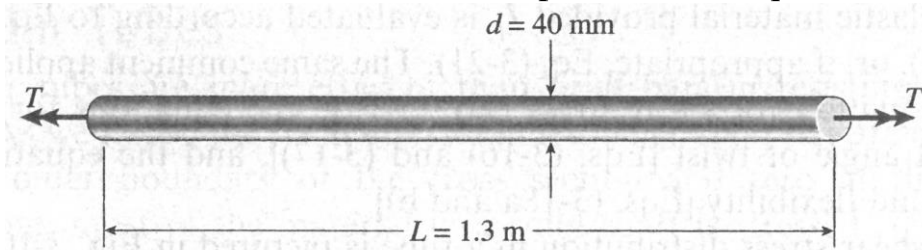

Fig. 2

3. An element in plane stress is subjected to stresses σx = 2900 kPa, σy = 9100 kPa, τxy = 3750 kPa (Fig.3). Using Mohr's circle, determine (a) the principal stresses, and (b) the maximum shear stresses and associated normal stresses. Show all results on sketches of properly oriented elements. (20%)
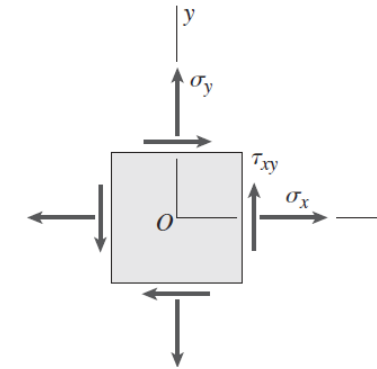

Fig. 3

4. A vertical wood post 2.5m high must support a lateral load P =12 kN at its upper end (Fig.4). What is the minimum required diameter d_1 of the post if the allowable bending stress in the wood is 15 MPa? (20%)
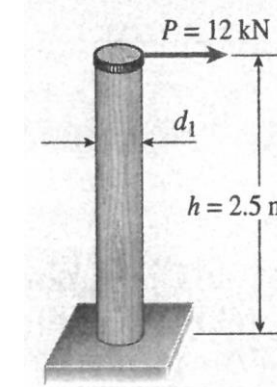

Fig. 4

5. A small dam of height h = 2.0m is constructed of vertical wood beams AB of thickness t = 120mm, as shown in the Fig.5. Consider the beams to be simply supported at the top and bottom. Determine the maximum bending stress σ_{max} in the beams, assuming that the weight density of water is γ = 9.81 kN/m³. (20%)
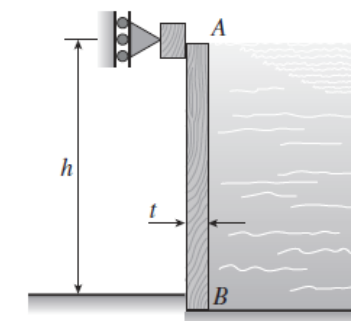

Fig. 5