國立嘉義大學99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：工程力學

說明：1.如有條件不足之情形，請自行假設。

2.僅可使用試務單位提供之計算機。

1. A cantilever beam of rectangular cross section as shown in Fig. 1, width b=25 mm, height h=100 mm is loaded by a force P that acts at the midheight of the beam and is inclined at an angle α to the vertical. The measured strains are $\varepsilon_a = 1.25\times10^{-4}$, $\varepsilon_b = -3.75\times10^{-4}$. Determine the force P (10%) and the angle α (10%), assuming the material is steel with E = 200 GPa, β=60°, and υ=1/3.

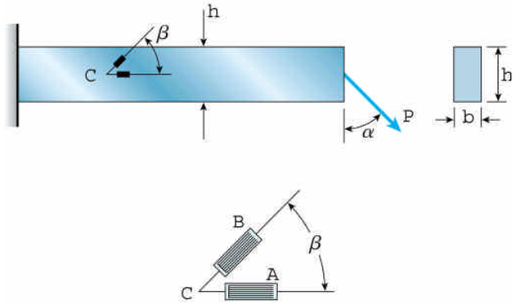

Fig.1

2. A structure consists of three steel bars supporting a load P applied through a rigid plate as shown in Fig. 2. The two outer bars have length L_1, the inner bar has length L_2, and all three bars have the same cross-sectional area A. The three steel bars are elastoplastic material (the yield stress σ_y and modulus of elasticity E) (a) determine the ratio of the plastic load P_p to the yield load P_y, (10%) and (b) determine the ratio of the corresponding yield displacement δ_p to the yield displacement δ_y. (10%)

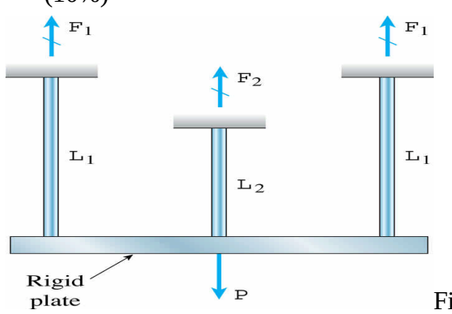

Fig.2

3. A solid steel shaft of diameter *d*=60 mm and length *L*=4 m is to be designed using an allowable shear stress τ_{allow} =40 MPa as shown in Fig. 3. Determine the maximum permissible torque T_{max} that may be applied to the shaft and the angle of twist ϕ. The shear modulus of elasticity *G*=80 GPa. (20%)

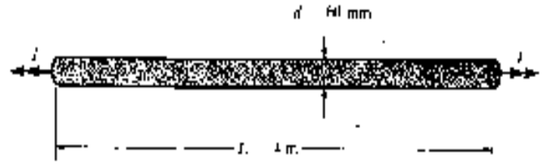

Fig. 3

4. A solid circular bar ABCD is held at ends A and D and subjected to axial forces as shown in Fig. 4. The two segments of the bar (AC and CD) have diameters 2 in and 4 in, respectively. (a) find the reaction force at D, (8%) (b) draw the axial force distribution diagram along the bar, (6%) (c) determine the maximum normal stress in the bar. (6%)

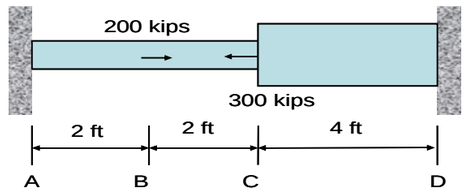

Fig. 4

5. A beam of rectangular cross section with height *h*=120 mm and width *b*=40 mm is constructed of steel with yield stress σ_y =250 MPa and *E*=210 GPa as shown in Fig. 5. Compute yield moment M_y (10%) and plastic moment M_p for this beam. (10%)

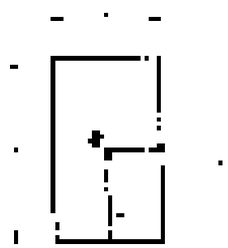

Fig. 5