編號： 136

國立成功大學 106 學年度碩士班招生考試試題

系　　所：航空太空工程學系

考試科目：材料力學

考試日期：0213，節次：1

※ 考生請注意：本試題不可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. **(20%)** An element in plane stresses is subjected to stresses σ_x = 15 MPa, σ_y = 5 MPa, and σ_{xy} = 4 MPa. Using Mohr's circle to determine (a) the principal stresses and planes (b) The stresses on the element rotated through an angle of 45, and (c) the maximum shear stress.

2. **(15%)** Consider the stepped shaft shown in Figure 1 rigidly attached to a wall at E, and determine the angle of twist of the end A when two torques at B and D are applied. Assume the shear modulus G to be 80 GPa.

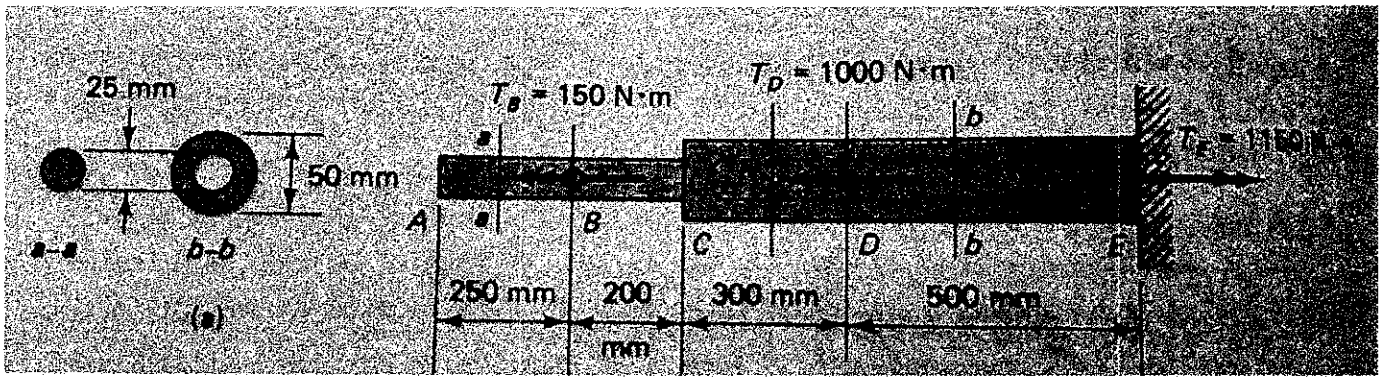


Figure 1

3. **(15%)** A rod *AB* as shown in Figure 2 is attached to the wall in both ends. If it is loaded by the axial forces *P* as shown, determine the stress at the middle of the bar. The cross section areas are A_b for part *b* (the middle part) and A_a for part *a* (both ends).

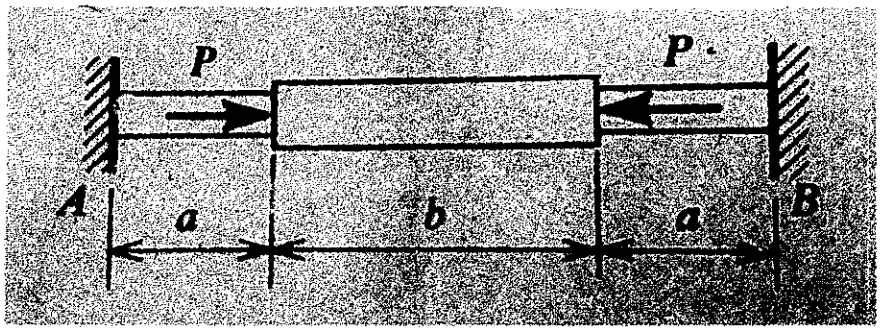


Figure 2

4. **(30%)** A simply supported wood beam *AB* with span length *L* carries a uniform load of intensity *q* (see Figure 3). (***Note:*** The Young's modulus of wood is denoted by *E*. The geometry of the beam is set to be L=50b and h=2b.)

(a) Calculate the maximum bending moment M_{max} and maximum shear force V_{max} of this beam. Indicate the cross section where the maximum bending moment or the maximum shear force occurs.

(b) Calculate the maximum normal stress σ_{max} and maximum shear stress τ_{max} of this beam. Indicate the point and

its orientation where the maximum normal stress or the maximum shear stress occurs.

(c) Calculate the maximum deflection δ_{max} of this beam. Indicate the location where the maximum deflection occurs.

(d) Calculate the angle of rotation θ_C at point C of this beam. (***Note:*** The distance between A and C is $L/4$.)

(e) Calculate the total strain energy stored in this beam.

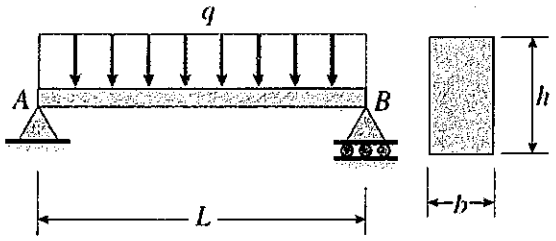


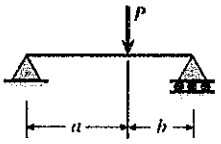
Figure 3

5. **(20%)** Follow **Prob.4** (see Figure 3)

(a) If a roller support is added at point C, determine the reactions R_A, R_B, and R_C for this beam. (***Note:*** The distance between A and C is $L/4$.)

(b) If an additional axial compressive force P is applied at end B, determine the critical buckling load P_{cr}. (***Note:*** No roller support at point C.)

Appendix:



$$v = -\frac{Pbx}{6LEI}(L^2 - b^2 - x^2) \qquad v' = -\frac{Pb}{6LEI}(L^2 - b^2 - 3x^2) \qquad (0 \le x \le a)$$

$$\theta_A = \frac{Pab(L+b)}{6LEI} \qquad \theta_B = \frac{Pab(L+a)}{6LEI}$$

$$\text{If } a \ge b, \quad \delta_C = \frac{Pb(3L^2 - 4b^2)}{48EI} \qquad \text{If } a \le b, \quad \delta_C = \frac{Pa(3L^2 - 4a^2)}{48EI}$$

$$\text{If } a \ge b, \quad x_1 = \sqrt{\frac{L^2 - b^2}{3}} \quad \text{and} \quad \delta_{max} = \frac{Pb(L^2 - b^2)^{3/2}}{9\sqrt{3}\,LEI}$$