淡江大學九十學年度碩士班招生考試試題

系別：航空太空工程學系　　科目：材　料　力　學

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本試題共 2 頁

1. Find the relationship that must exist between the normal stress $\sigma(\theta)$ and shear stress $\tau(\theta)$ at the cross-section of the bar shown in *Figure* 1, such that the resultant stress in the longitudinal direction is only axial. Determine the resulting axial normal stress σ_n in terms of $\sigma(\theta)$ and $\tau(\theta)$, and show that the result is explicitly independent of the angle θ. (20%)

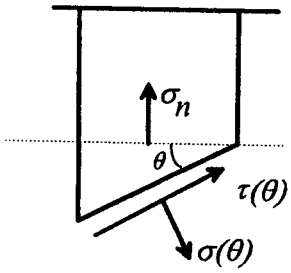

Figure 1.

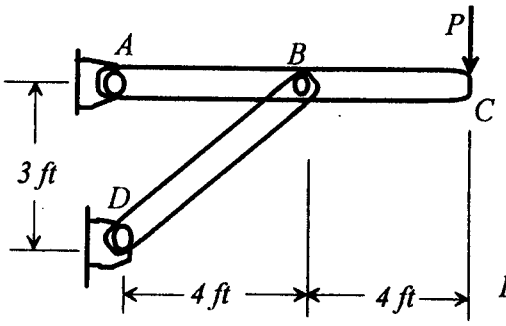

Figure 2.

2. The rigid bar *ABC* is hinged at *A* and supported by link *BD* at *B* as shown in *Figure* 2. Link *BD* is made of steel (E=30 x 10^6 *psi*) and has a diameter of 2.5 inches. Find the magnitude of the applied load *P* if the vertical displacement of point *C* is 0.136 inches. (20%)

3. A beam of square cross-section is to be used to carry a pure bending moment. The beam can be mounted in either of two configurations as shown in *Figure* 3-*a*, and 3-*b*, with bending about the horizontal axis. The material is linearly elastic.

(a) Determine the moment of inertia for configuration *A* (*Fig.*3-*a*) in terms of *d*. (5%)
(b) Determine the moment of inertia for configuration *B* (*Fig.*3-*b*) in terms of *d*. (5%)
(c) If the same maximum allowable bending stress is permitted for either case, determine the ratio of the maximum bending moments M_A/M_B. (10%)

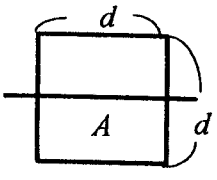

Figure 3-a.

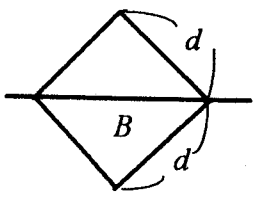

Figure 3-b.

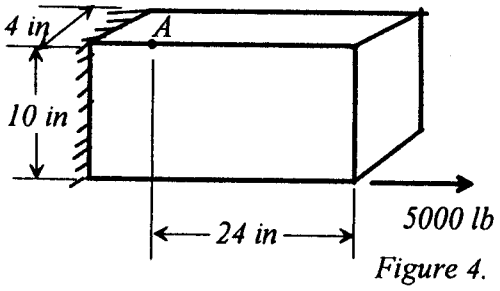

Figure 4.

4. Determine the normal stress at point *A* for the figure shown in *Figure* 4. (20%).

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5. A copper bar 1 *m* in length is attached to a wall on the left hand side as shown in *Figure* 5. For a 60°*C* rise in temperature, determine the stress produced in the bar. Consider both walls rigid and immovable. Assume coefficient of linear expansion, α=0.0000168 /°C, and modulus of elasticity, *E*=117 *GPa*. (20%).

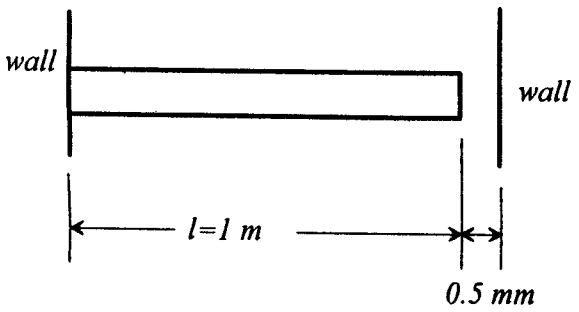

Figure 5.