

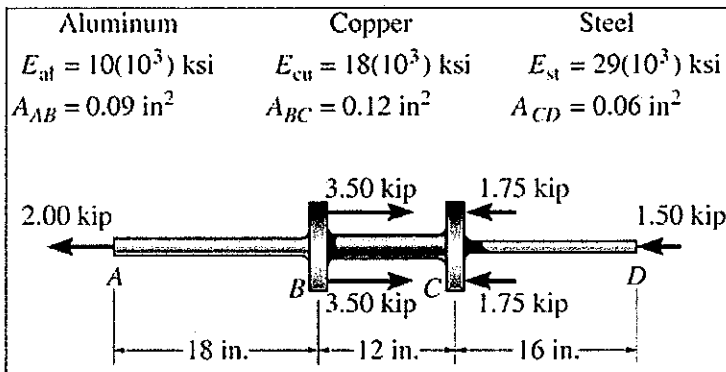
所別： 機電工程研究所 組別： 精密機械組 科目： 材料力學

注意：准  一般計算器  工程用計算器，考試時間總計：100 分鐘。試題共 2 頁，第 1 頁

**Total Marks: 100**

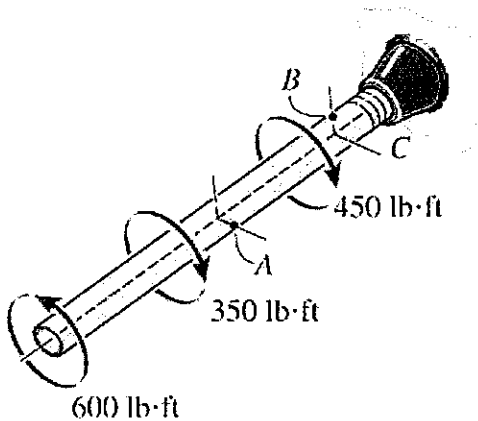
**1. (30 Marks)**

The composite shaft, consisting of aluminum, copper, and steel sections, is subjected to the loading shown. Determine the displacement of end *A* with respect to end *D* and the normal stress in each section. The cross-sectional area and modulus of elasticity for each section are show in the figure. Neglect the size of the collars at *B* and *C*.



**2. (20 Marks)**

The copper pipe has an outer diameter of 2.50 in. and an inner diameter of 2.30 in. If it is tightly secured to the wall at *C* and three torques are applied to it as shown, determine the shear stress developed at point *A* and *B*. These points lie on the pipe's outer surface. Sketch the shear stress on volume elements located at *A* and *B*.



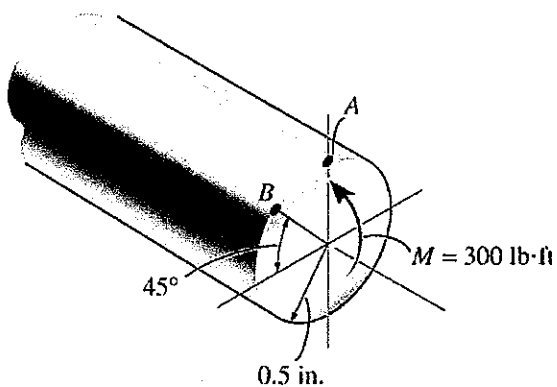
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**3. (20 Marks)**

The steel rod having a diameter of 1 in. is subjected to an internal moment of  $M = 300 \text{ lb}\cdot\text{ft}$ . Determine the stress created at points  $A$  and  $B$ . Also sketch a three-dimensional view of the stress distribution acting over the cross-section.



**4. (30 Marks)**

A beam with a square cross section is subjected to a shear of  $V = 1500 \text{ lb}$ . If the allowable shear stress is  $1.4 \text{ ksi}$ , determine the smallest dimension of its sides.