

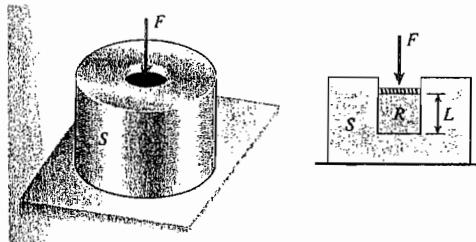
## 國立台灣科技大學九十五學年度碩士班招生試題

系所組別：機械工程系碩士班甲組、乙組

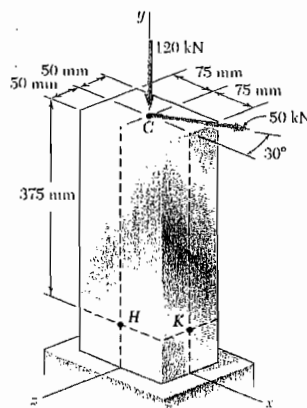
科目：材料力學

總分 100 分，每題 25 分。

1. A rubber cylinder  $R$  of length  $L$  and cross-sectional area  $A$  is compressed inside a steel cylinder  $S$  by a force  $F$  that applies a uniformly distributed pressure to the rubber, as shown below.
- (a) Derive a formula for the lateral pressure  $p$  between the rubber and the steel.  
(Disregard friction between the rubber and the steel, and assume that the steel cylinder is rigid when compared to the rubber.)
- (b) Derive a formula for the shortening  $\delta$  of the rubber cylinder.



2. For the post and loading shown below, determine the principal stresses and maximum shear stress at point  $H$ .

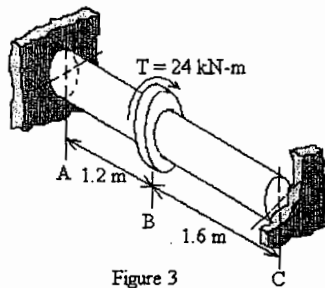


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3. A solid steel ( $G = 40\text{GPa}$ ) shaft is rigidly secured at both ends. The radius of the shaft is 10 cm. A torque  $T$  is applied at collar B as shown in Figure 3. Determine
- The maximum shearing stress in the shaft.
  - The angle of rotation of the section where the given torque is applied.



4. A cantilever steel beam ( $E = 200\text{GPa}$ ,  $I = 2.4\text{ cm}^4$ ) is to be loaded at end. Under the end point there is a acrylic column ( $E = 4\text{ GPa}$ , cross-sectional area  $40\text{ mm}^2$ ). The initial clearance between the beam and the column is  $d$ . Determine the reaction force of the column after the load  $P$  is applied. The numerical values are given as:  $L = 600\text{ mm}$ ,  $S = 800\text{ mm}$ ,  $P = 6\text{ kN}$ ,  $d = 30\text{ mm}$ .

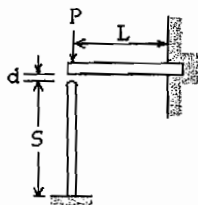


Figure 4

