



Question One: (10 Marks)

The plastic block shown in Fig. 1 is bonded to a rigid support and to a vertical plate to which a 240 kN load P is applied. Knowing that for the plastic used $G = 1050 \text{ MPa}$, determine the deflection of the plate.

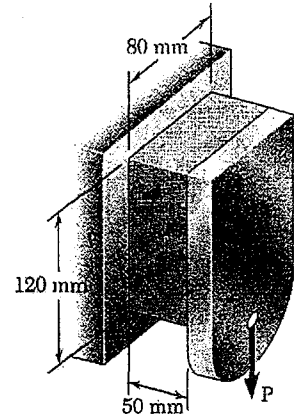


Fig. 1

Question Two: (15 Marks)

A compound shaft consisting of a steel segment and an aluminum segment is acted upon by two torques as shown in Fig. 2. Determine the maximum permissible value of T subject to the following conditions: $\tau_{st} \leq 83 \text{ MPa}$, $\tau_{al} \leq 55 \text{ MPa}$, and the angle of rotation of the free end is limited to 6° . For steel, $G = 83 \text{ GPa}$ and for aluminum, $G = 28 \text{ GPa}$.

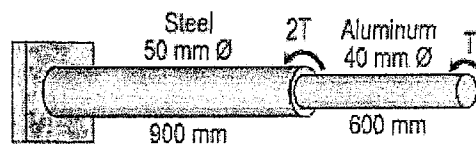


Fig. 2

Question Three: (15 Marks)

A 400 lb vertical force is applied at D to a gear attached to the solid 1 in diameter shaft AB. Determine the principal stresses and the maximum shearing stress at point H located as shown in Fig. 3 on the top of the shaft.

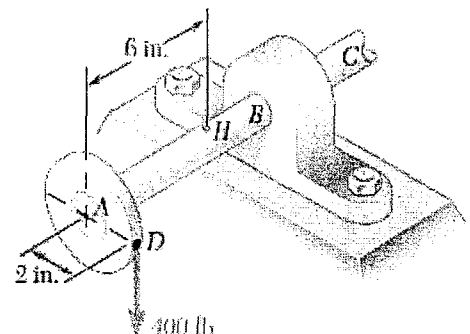


Fig. 3

Question Four: **(10 Marks)**

(1) For a beam, if fundamental equations of statics are not sufficient to determine all the reactive forces at the supports, the structure is said to be ...

- (a) *Determinate* (b) *Statically Indeterminate*
(c) *Statically Determinate* (d) *None of these*

(2) *Brittle materials generally fail in shear. Ductile materials are weaker in tension than shear.*

- (a) *True* (b) *False*

(3) For a hollow shaft of $d_o = 50\text{mm}$ & $d_i = 35\text{mm}$ subjected to a torque of 65KNm , shear stress at the outer surface is that at the inner surface of shaft.

- (a) > (b) < (c) = (d) otherwise

(4) Modulus of Elasticity is considered a measure of ...

- (a) *Stiffness* (b) *Strength* (c) *Toughness* (d) *Resilience*

(5) A steel bar of 5mm is heated from 15°C to 40°C and it is free to expand. The bar will induce

- (a) Tensile Stress (b) Compressive Stress (c) No Stress (d) Shear Stress

Good Luck

Assoc. Prof. Dr. Noha Fouda