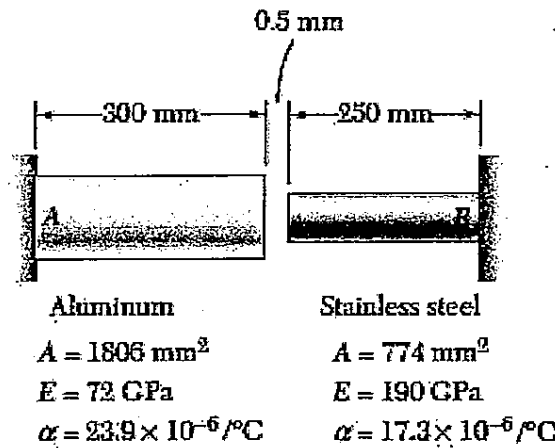


※ 考生請注意：本試題可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

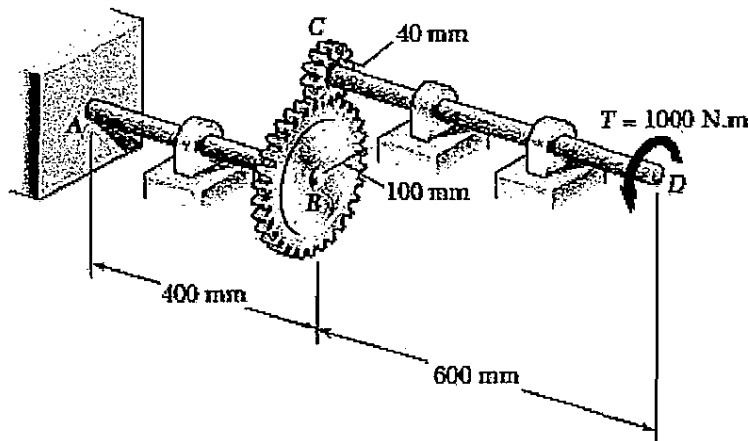
1. (20pts) Explain the following terms:

(a) thermal strain, (b) strain hardening, (c) necking, (d) elastic torsion formula, (e) four-point bending, (f) method of the transformed section, (g) idealized elastoplastic material, (h) maximum-normal-stress criterion, (i) symmetric bending, (j) Castigliano's theorem.

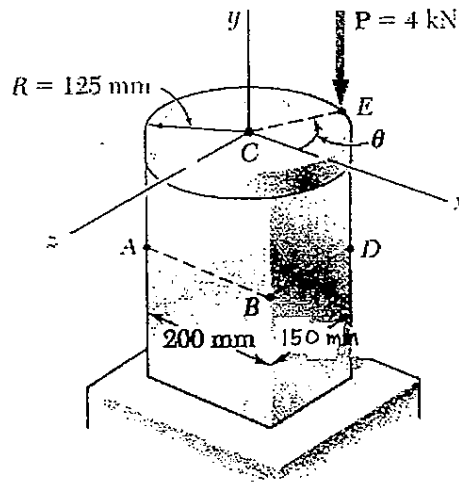
2. (20pts) At room temperature (21°C) a 0.5 mm gap exists between the ends of the rods shown. At a later time when the temperature has reached 160°C , determine (a) the normal stress in the aluminum rod, (b) the change in length of the aluminum rod.



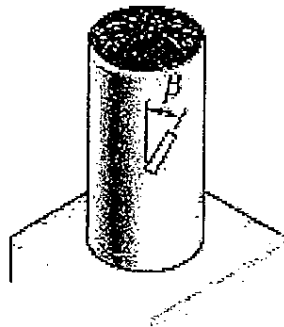
3. (15pts) The design of the gear-and-shaft system shown requires that steel shafts of the same diameter be used for both AB and CD . It is further required that $\tau_{\text{max}} \leq 60 \text{ MPa}$ and that the angle ϕ_D through which end D of shaft CD rotates not exceed 1.5° . Knowing that $G = 77 \text{ GPa}$, determine the required diameter of the shafts.



4. (20pts) A rigid circular plate of 125-mm radius is attached to a solid 150×200 mm rectangular post, with the center of the plate directly above the center of the post. If a 4-kN force P is applied at E with $\theta = 30^\circ$, determine (a) the stress at point A , (b) the stress at point B , (c) the point where the neutral axis intersects line ABD .



5. (15pts) A single strain gage forming an angle $\beta = 30^\circ$ with the vertical is used to determine the gage pressure in the cylindrical steel tank shown. The cylindrical wall of the tank is 10 mm thick, has a 900 mm inner diameter, and is made of a steel with $E = 200$ GPa and $\nu = 0.30$. Determine the pressure in the tank corresponding to a gage reading of 220×10^{-6} mm/mm.



6. (10pts) For the beam and loading shown, determine the reaction at the roller support.

