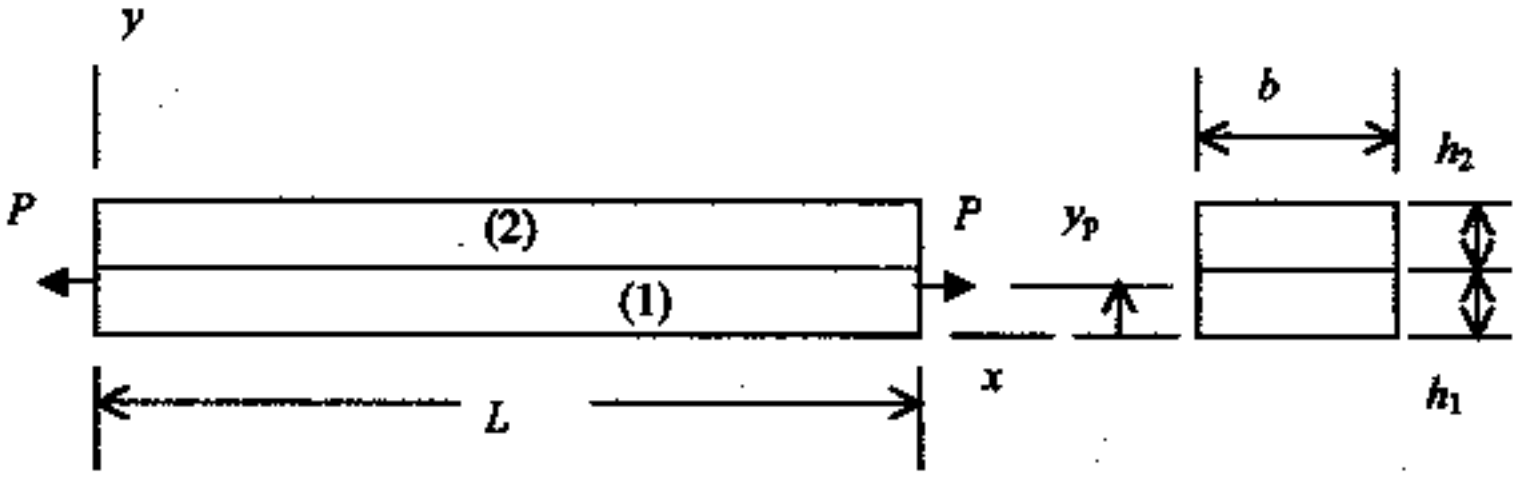
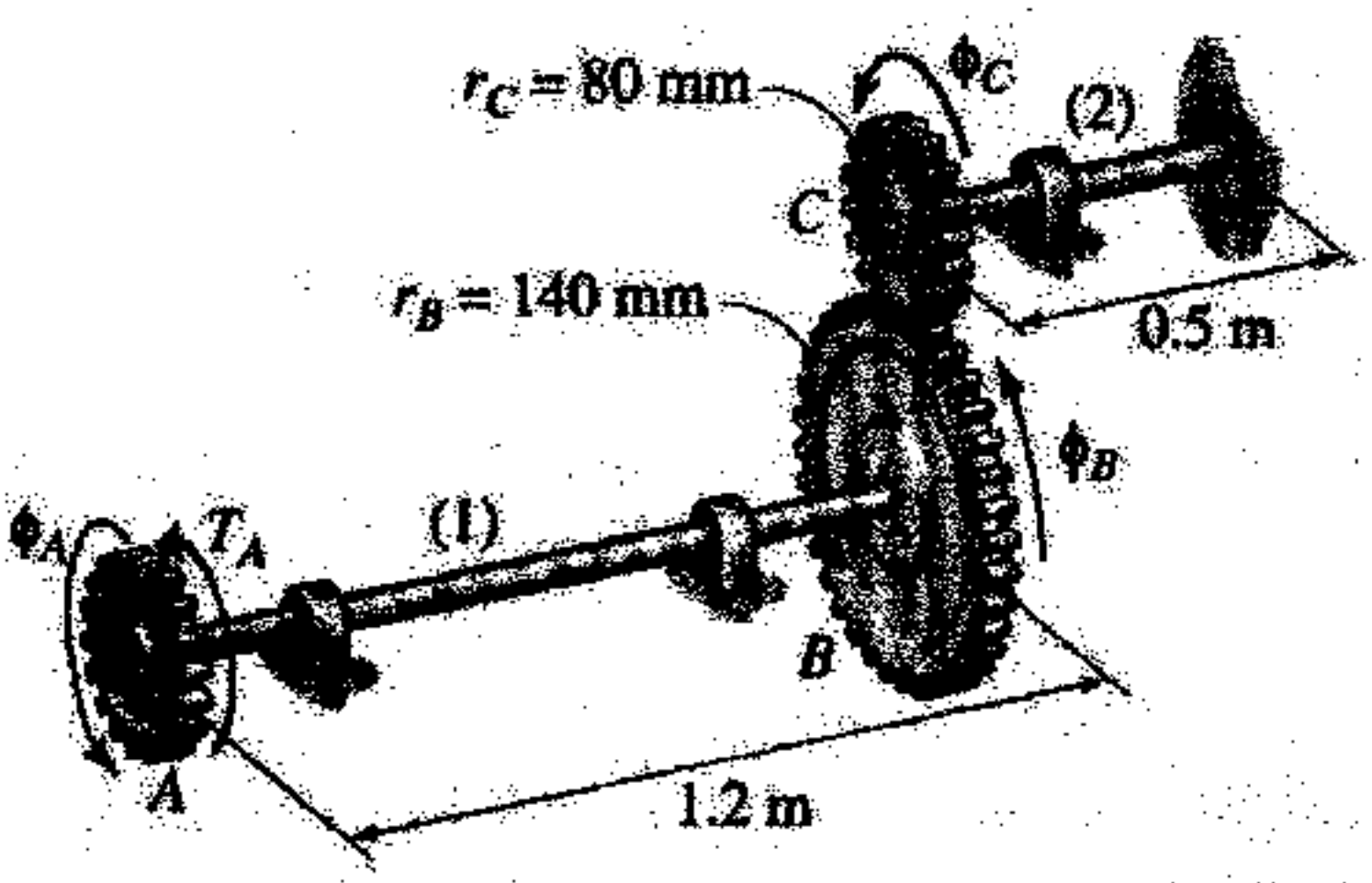
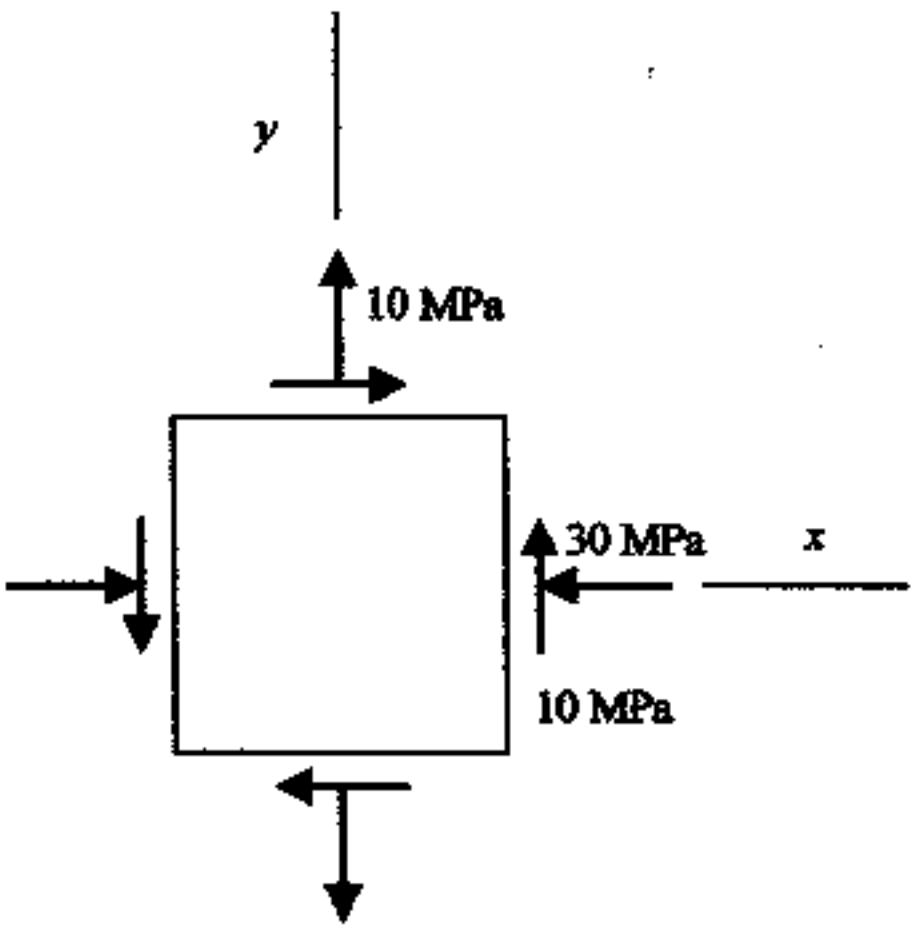
1. For the bimetallic bar shown below, $E_1 = 30 \times 10^3$ ksi, $L = 100$ in., $b = 2$ in., and $h_1 = h_2 = 0.6$ in. (a) If the bimetallic bar undergoes axial deformation under the action of load $P$ at $y_p = 0.4$ in., what is the value of the modulus of elasticity, $E_2$, of material (2)? (b) Determine the total elongation of the bar for a load of $P = 2$ kips. (25%)




2. A torque $T_A$ is applied to gear $A$ of the two-shaft system, producing a rotation $\phi_A = 0.05$ rad. The shafts are made of steel ($G = 80$ GPa), and each has a diameter of $d = 32$ mm. The shafts are supported by frictionless bearings, and end $D$ of shaft $CD$ is restrained (固定). (a) Determine the angle of rotation of gear $C$ and the angle of rotation at gear $B$. (b) Determine the internal torques in shafts (1) and (2). (c) Determine the maximum shear stress in the two-shaft system. (25%)



3. For the plane-stress state of an element shown below, do the following:
   (a) Construct a Mohr's circle of stress. (7%)
   (b) Determine the principal stresses and show them on a properly oriented stress element. (10%)
   (c) Determine the maximum shear stresses and the normal stress on the planes of maximum shear, and show these on a sketch of a properly oriented stress element. (8%)



4. The fixed-fixed beam is subjected to a uniformly distributed load of intensity $w_0$ over the interval $AB$ (i.e., $0 \le x \le a$). (a) Use the fourth-order integration method to determine the reactions at $A$ and $C$ and the deflection-curve expression $v_a(x)$ (for $0 \le x \le a$) and $v_b(x)$ (for $a \le x \le L$). (b) Letting $a = L/2$, sketch the complete shear diagram, $V(x)$, for this beam. (25%)