(15%) 1. A metal plate of length L and width b is subjected to a uniform tensile stress σ at the ends (see Fig.1). Before loading, the slope of the diagonal line OA was b/L. What is the slope when the stress σ is acting?

(15%) 2. Each of the bars AB and BC of the truss shown in Fig.2 has cross-sectional area A and modulus of elasticity E. (a) Determine the strain energy U in the truss due to the horizontal load P. (b) Determine the horizontal deflection δ of joint B.

(15%) 3. Strain gauges oriented in the x and y directions are attached to a thin rectangular steel plate as shown in Fig.3. The plate is subjected to uniform normal stresses σ_x and σ_y. The strain gauges give reading $\varepsilon_x = 500 \times 10^{-6}$ and $\varepsilon_y = 100 \times 10^{-6}$. Assuming that $E = 200$ GPa and Poisson's ratio, $\nu = 0.30$, calculate the stresses σ_x and σ_y.

(15%) 4. A torque T is applied to a solid circular bar of diameter d, and the maximum normal stain ε on the surface of the bar (at 45° to the axis) is measured. Obtain a formula for the shear modulus of elasticity G in terms of T, d, and ε.

(40%) 5. Expain the following mechanical terms

(1) Pure shear
(2) Flexure formula
(3) Shear formula
(4) Critical loads of a column
(5) Principal stresses
(6) Moment - area method
(7) Buckling
(8) Strain energy

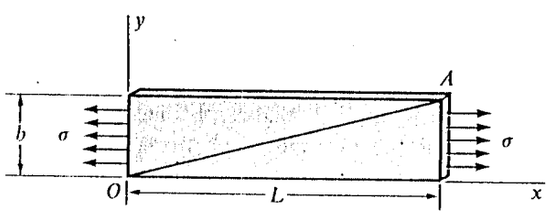

Fig. 1

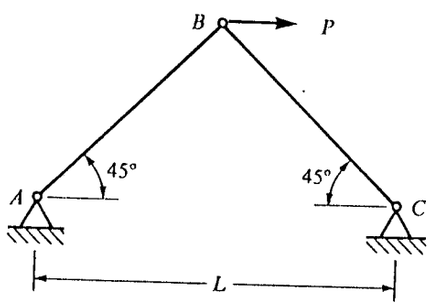

Fig. 2

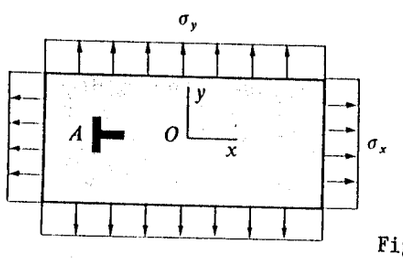

Fig. 3