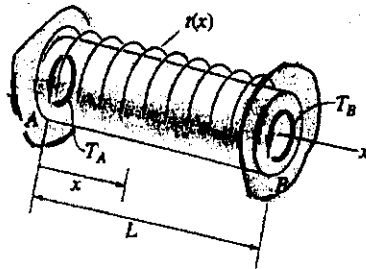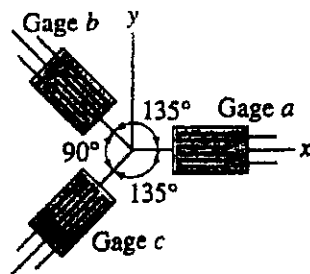本試題是否可以使用計算機: ☑可使用 , □不可使用   (請命題老師勾選)

1. (25%)   A uniform shaft of diameter d and length L is subjected to a distributed external loading $t(x)=t_0[1-(x/L)^2]$, where t_0 is a constant. Determine the (torque) reactions, T_A and T_B, at the fixed supports at A and B.


2. (25%) At a point on the surface of a steel machine component, the strain rosette (shown in the Figure below) measured the following extensional strains: ε_a= 700 μ, ε_b= 560 μ, and ε_c= -280 μ.

(a) Determine the strain components ε_x, ε_y and γ_{xy} at the rosette location.

(b) Determine the stress components σ_x, σ_y and τ_{xy} at the rosette location.

(c) Using a Mohr's circle for strain, determine the principal strains and the maximum shear strain at the point.

(d) Letting E = 30 x 10^3 ksi (i.e. 210 GPa) and ν = 0.30, determine the principal stresses and the absolute maximum shear stress at the point.

(背面仍有題目,請繼續作答)

3. (25%) A fixed-end beam AB of length L supports a uniform load of intensity q.

Find the *maximum bending moment* and the *maximum deflection* of the beam.
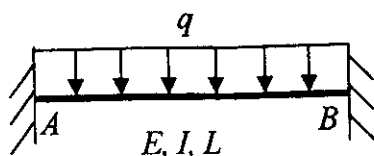
4. (25%) The system shown below consists of two bars AB and BC, each of bending stiffness EI and length L, elastically hinged together at B by a *torsional spring* of stiffness K.
   (a) Derive an equation for the buckling load P_{cr} of the system.
   (b) Find the lowest buckling loads when (i) $K \to \infty$ and (ii) $EI \to \infty$, respectively.
   (c) Justify the results you obtained in (b).