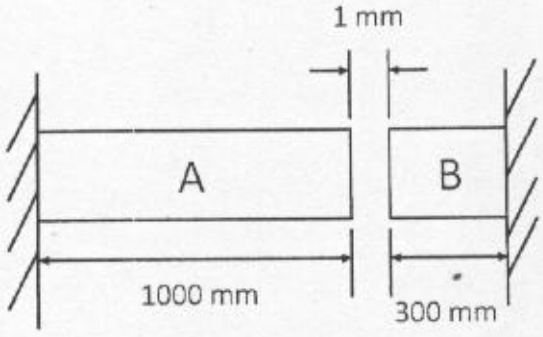
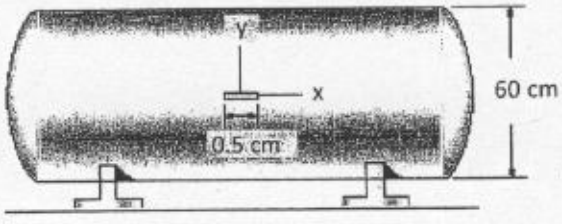
●不可使用電子計算機

1. A rod (E = 50 GPa and $\alpha = 20\times10^{-6}/^{\circ}C$) and B rod (E = 100 GPa and $\alpha = 30\times10^{-6}/^{\circ}C$) are connected to rigid supports as shown below. The cross-sectional area of A rod and B rod are 2,000 mm^2 and 3,000 mm^2, respectively. Determine the normal stress in each rod if the temperature increase is $+80^{\circ}C$. (20%)



2. A strain gauge is placed on the surface of a thin-walled pressure vessel as shown below. The pressure vessel has a thickness of 0.5 cm and inner diameter of 60 cm. The strain gauge is 0.5 cm long. The Young modulus and Poisson's ratio of the vessel material are 200 GPa and 0.3, respectively. When the gauge elongates 0.4×10^{-3} cm, determine
   (a) the pressure in the vessel; (10%)
   (b) the absolute maximum (*out-of-plane*) shear stress at the position of gauge on the inner surface of the vessel. (10%)



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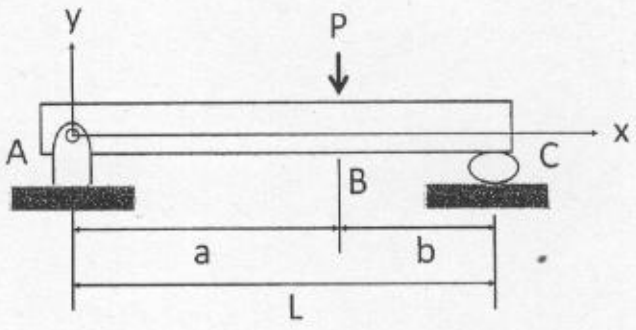
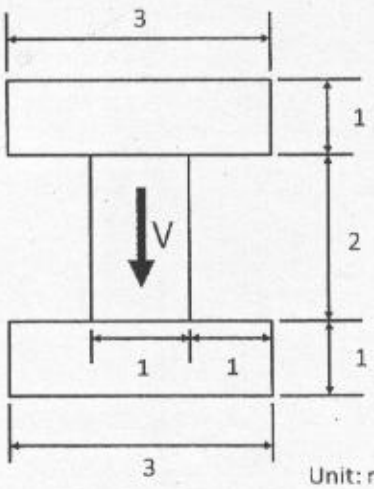
3. The simple beam is subjected to the concentrated force P. Determine (a) the equations of the elastic curve (10%), and (b) the beam slopes at supports A and C. EI is constant. (10%)



4. The cross-sectional area of a wide-flange beam is shown below. The beam is subjected to a shear of V = 50 kN. Determine the shear force resisted by two flanges. (20%)



5. The flexure formula $\sigma = -\frac{My}{I}$ is used to determine the bending stress at any point in a cross section of a beam. Derive this formula with all the assumptions clearly stated. (20%)