1. The tube is made of C86100 bronze (shear modulus of elasticity G is $38 \times 10^9\ MPa$) and has a rectangular cross section as shown in Fig. 1. The tube is fixed at E.
(1) If it is subjected to the two torques, determine the average shear stresses in the tube at points A and B. (16%)
(2) What is the angle of twist at end C? (9%)

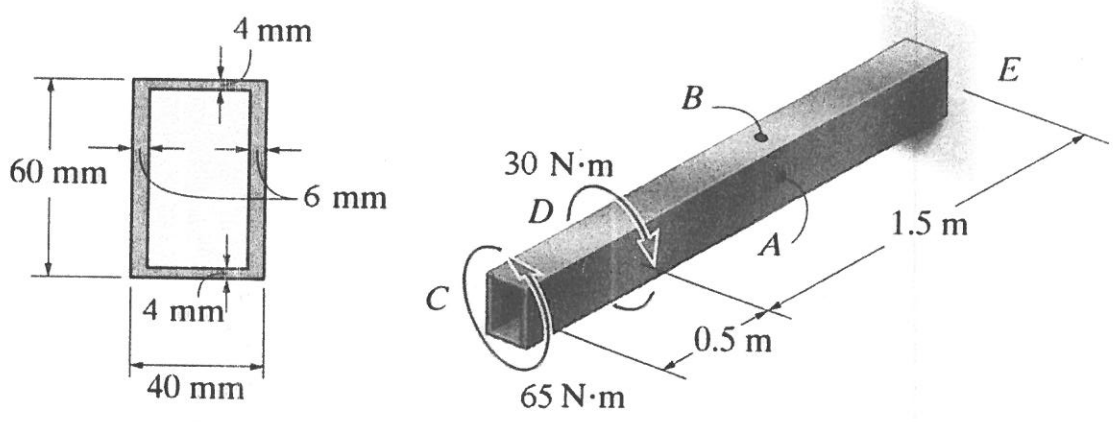

Fig.1

2. The member shown in Fig. 2 has a rectangular cross section. Determine the state of stress that the loading produces at point C. (25%)

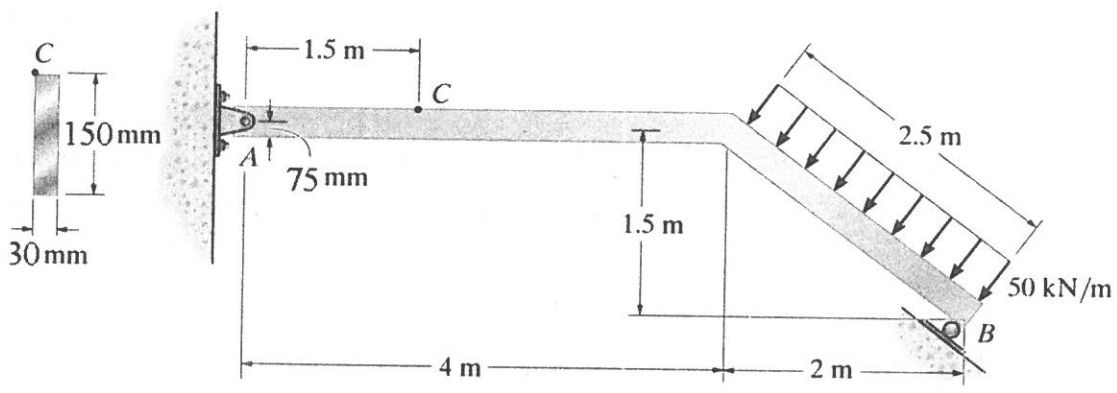

Fig. 2

3. A cylindrical pressure vessel of an inner radius r of $0.5\,m$, a vessel length L of $3\,m$, and wall thickness t_c of $10\,mm$ is subjected to an internal pressure p of $15\,MPa$, as shown in Fig. 3. The pressure vessel is made of titanium alloy with $E = 120\,GPa,\ \nu = 0.36,\ \sigma_Y = 950\,MPa$.

(a) Determine the **stress** state and **strain** state at point A. (12%)
(b) Determine the principal stresses, maximum shear stress and their directions at point A using **Mohr's** circle. (6%)
(c) Determine the principal strains and maximum shear strain at point A using **Mohr's** circle. (6%)
(d) If the internal pressure continuously increases, determine the allowable pressure before yield by using the **maximum-distortion-energy** theory (or **von Mises** yield criterion). (6%)

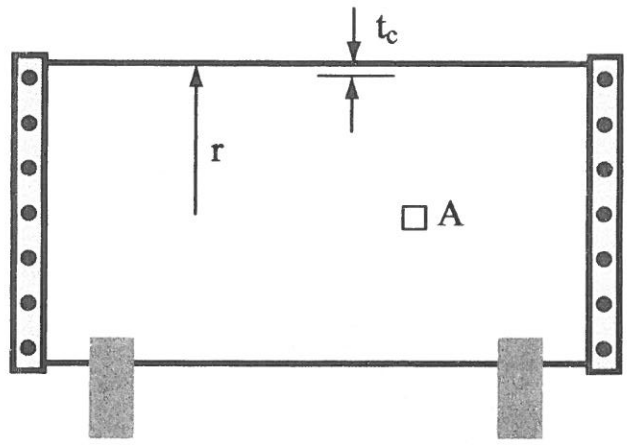

Fig. 3

4. The wooden beam is subjected to the load shown in Fig. 4. Determine the equation of the elastic curve by using the **discontinuity function** method. Specify the deflection at the end C. Let $E_w = 15\,GPa,\ \nu = 0.25$. (20%)

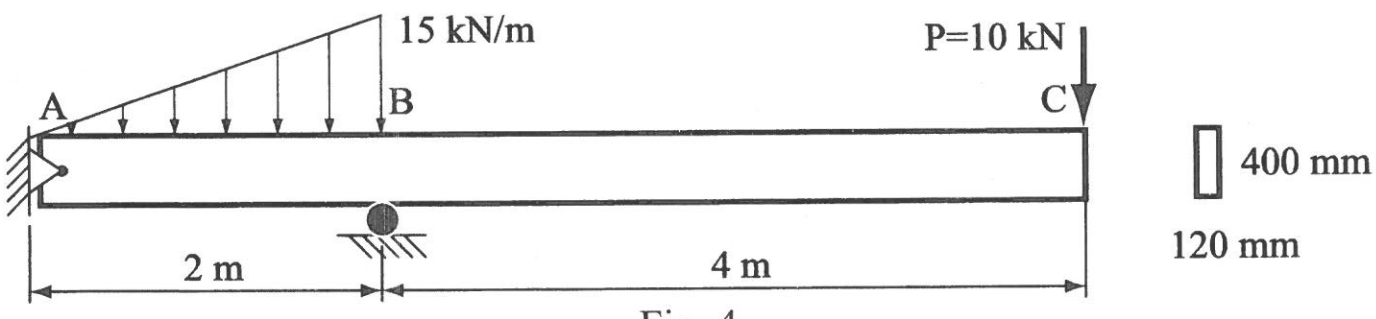

Fig. 4