1. A hollow steel shaft with an outside diameter of 100 mm and an inside diameter of 75 mm is subjected to a pure torque of 7.5 kN·m. The modulus of rigidity $G$ (shear modulus) for the steel is 80GPa. Determine the maximum shearing stress in the shaft and the angle of twist in a 2-m length. (20%)

2. A timber beam, loaded and supported as shown in the following, has the cross section shown in Fig.1(b). On a section 1.2 m from the left end, determine the fiber stresses at point A and B of the cross section. (30%)



(a) loading　　　(b) cross section
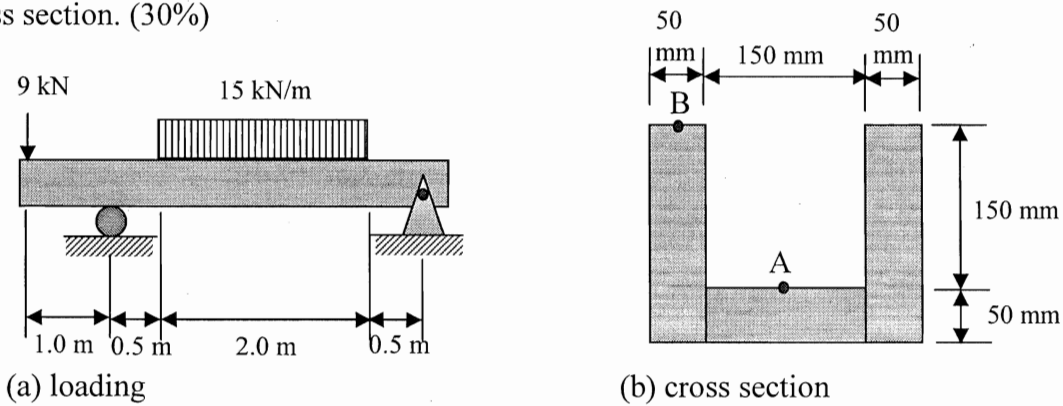
Prob.2  A timber beam subjected to tranverse load

3. A 3-section bar is subjected to forces as shown. Find the displacement of the end point C. The symbol $d_i$ and $E_i$ represent the diameter and modulus of the bar $i$, respectively. (15%)
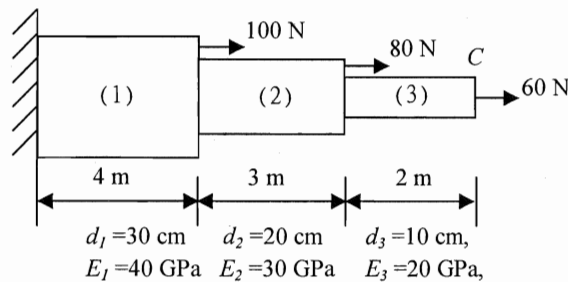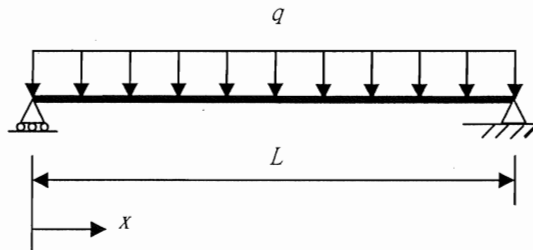


Prob.3  A simply supported beam subjected to forces

4. A cantilevel beam is subjected to both a distributive load and a concentrated force, as shown in the following. Find (1) the maximum normal stress $\sigma_{max}$, (2) the maximum shear stress $\tau_{max}$ in the beam. The cross-section has a I shape, as shown. (20%)
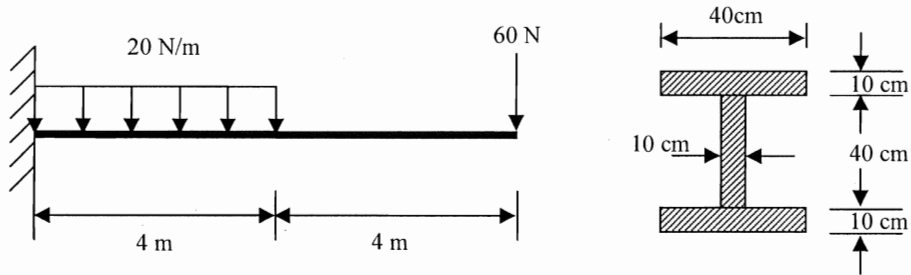


Prob.4  A cantilevel I-beam subjected to two loads

5. Drive the equation of the beam deflection v(x), expressed in terms of $E$, $I$, $q$ and $x$. (15%)



Prob.5  A simply supported beam is subjected to a uniform distributed load