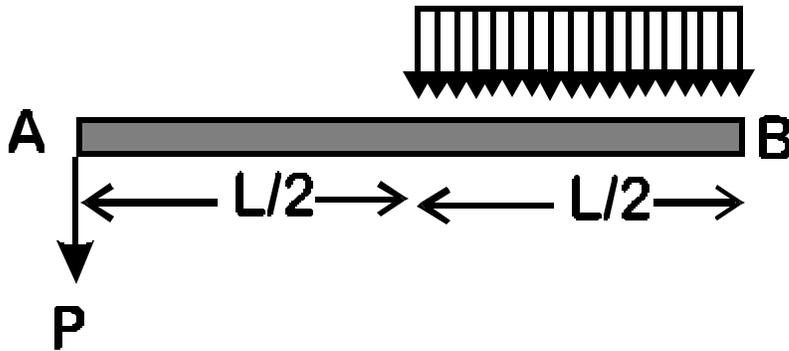


STRUCTURAL MECHANICS Revision examples

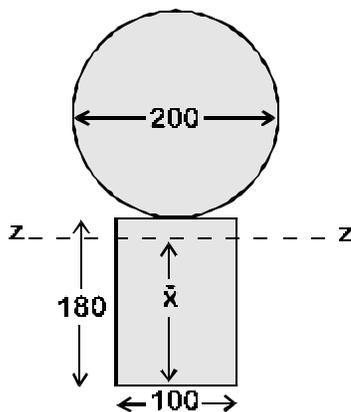
1. Consider the cantilever with B built-in, a concentrated force at the free end and a uniformly distributed load over the right hand half of the beam. Using step functions, write equations for the shearing force and bending moment at any point on the beam and plot the shear and bending moment diagrams.



2. (1996 Q2) A thin walled cylinder with closed ends, diameter d and thickness t is subjected to an internal pressure p . Two strain gauges are placed in the longitudinal and circumferential directions respectively to measure the longitudinal strain (ϵ_l) and the circumferential strain (ϵ_h). Assuming the radial stress in the wall thickness is zero (i.e. plane stress system), derive the expressions for deriving the elastic modulus (E) and Poisson's ratio (ν) for the material for the cylinder from the measurements of (ϵ_l) and (ϵ_h).

If the ratio of the longitudinal strain (ϵ_l) to the circumferential strain (ϵ_h) is 0.24, what is the Poisson's ratio of the material of the cylinder?

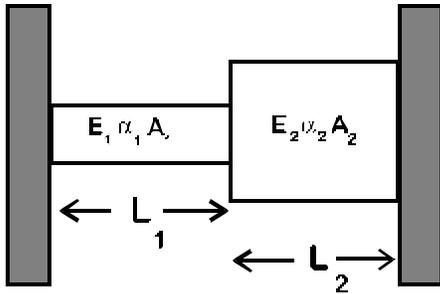
3. Calculate the position \bar{y} of the centroid, and its second moment of area about a horizontal axis through the centroid zz , for the given shape. All dimensions are in mm.



4. (1996 Q3) Two elements are welded together at B and welded to rigid walls at A and C (See figure). Subsequently element 1 is heated by an amount of temperature ΔT , while element 2 is held at the reference temperature. Assume that the cross-section areas A_1 and A_2 , the elastic moduli E_1 and E_2 , the lengths L_1 and L_2 and the thermal expansion coefficients α_1 and α_2 are all known.

Determine:

- (i) The displacement at B
- (ii) The internal forces in each element



5. (1995 Q8) Assume the value EI for the beam shown is known.

Do the following

- (i) Calculate the reactions at A and C
- (ii) Derive the expressions for the slope and deflection
- (iii) Determine the maximum slope and the maximum deflection and state where they occur.

