INDIAN INSTITUTE OF TECHNOLOGY

Date ..
.... FN / AN   Time : 2 ⅓ Hrs.   Full Marks ..30   ..... No. of Students 173

Autumn / Spring Semester, 2010   Deptt. ..Mechanical Engineering   .... Sub. No. ..ME31013

3rd Yr. B.Tech. (H) / B.Arch. (H) / M.Sc.   Sub. Name ...Mechanics of Solids

Instruction .Answer all questions. All questions carry equal marks

1. (a) The general displacement field in a body in Cartesian coordinates is given by

$$u = 0.015 \, x^2y + 0.03$$
$$v = 0.005 \, y^2 + 0.03xz$$
$$w = 0.003z^2 + 0.001yz + 0.005$$

Find the principal strains at the point (1, 0, 2)

(b) A material yields at 200MPa in uniaxial tension and a thin-walled pressure vessel is fabricated out of this. If the radius is 1m and the thickness in 20mm find the pressure at which the material fails according to octahedral shear stress theory

2. A quadrant of radius R is loaded as shown below. Using Castigliano's theorem determine the horizontal deflection at the end B in terms of W, R and the flexural rigidity EI.
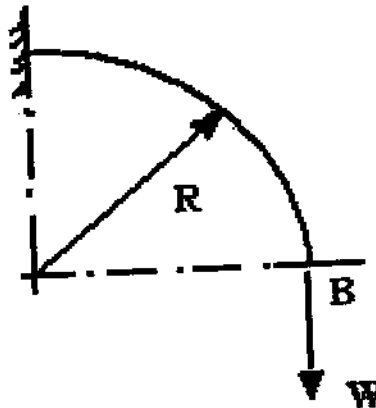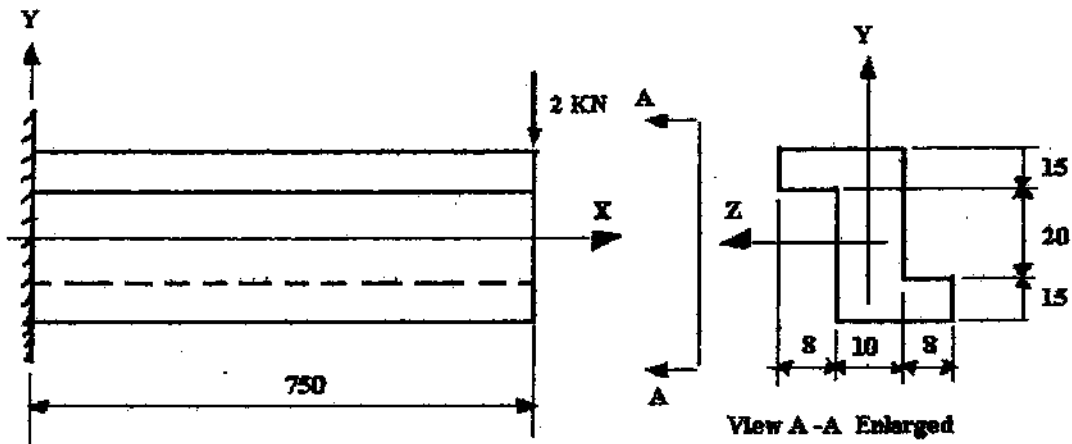

3. Find the shear centre for the thin walled square split section shown below.
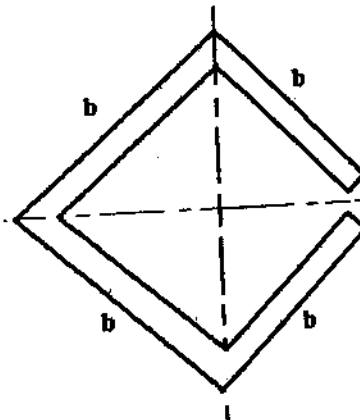
4. A curved beam with a circular centre line has the trapezoidal cross-section as shown in the figure. The beam is subjected to pure bending in its plane of symmetry. The face b_1 is the concave side of the beam. Determine b_2 if $b_1 = a = h = 100$ mm and the tension and compression in the extreme fibers are equal.
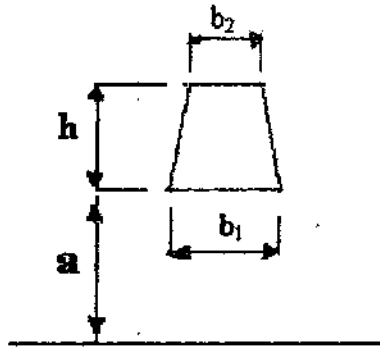
5. For the beam shown below determine the bending stresses at $(0, 25, 13)$ and $(0, -25, -13)$

All dimensions in mm