

MMME2053 - Mechanics of Solids
Exercise Sheet 11 - Shear Stresses/Shear Centre

1. A simply supported rectangular beam has a depth of 150 mm, a width of 75 mm and a span of 2 m. It carries a load of 5 kN at the centre of the span, find the shear stress and the normal stress at a point 50 mm from the neutral axis, on a section perpendicular to the axis of the beam at a distance of 0.75 m from one support.
[Ans: 0.185 MPa, 4.44 MPa]

2. Fig. Q2 shows the cross-section of a solid beam which carries a vertical shear force of 100 kN.

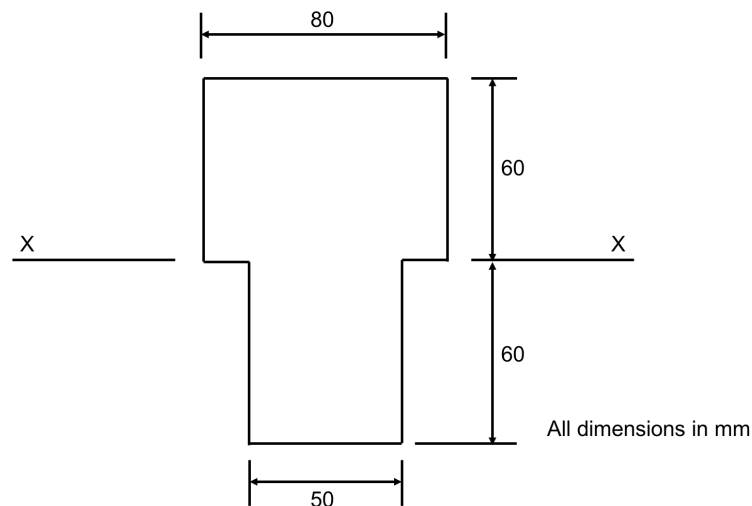


Fig. Q2

- Determine the shear stress just above and just below the line X-X
- Determine the shear stress at the Neutral Axis of the section
- Sketch the shear stress distribution through the section and state where the maximum shear stress occurs.

[Ans: a) 15.41 MPa, 24.65 MPa b) 15.68 MPa]

3. The outer dimensions of a channel girder section are 120 mm (web) x 50 mm (flanges); the web of the flanges are 5 mm thick. Determine the position of the shear centre of the section

[Ans: 16.9mm from the central plane of the web, on the axis of symmetry]

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4. Show that the difference between the maximum and mean shear stress in the web of an I beam is:

$$\frac{Sd^2}{24I}$$

where d is the height of the web.

5. For a T-section beam with a flange 120 mm by 10 mm and a web 100 mm by 10 mm, what percentage of the shearing force at any section is carried by the web?

[Ans: 93.6 %]

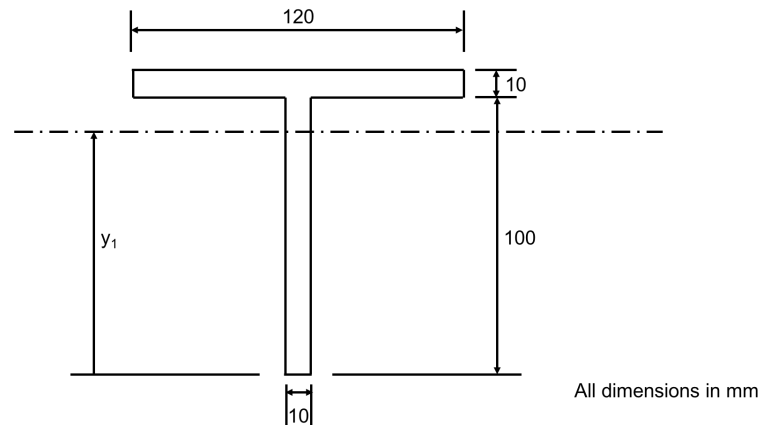


Fig. Q5.

6. A length of channel girder from Q3 is loaded as a cantilever by an end load of 1.2kN acting in the plane of the web. What twisting moment acts at a general section of the cantilever?

[Ans: 20.3 Nm]

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7. Find the shear centre of the beam cross-section shown in Fig. Q7 (t is much smaller than R).

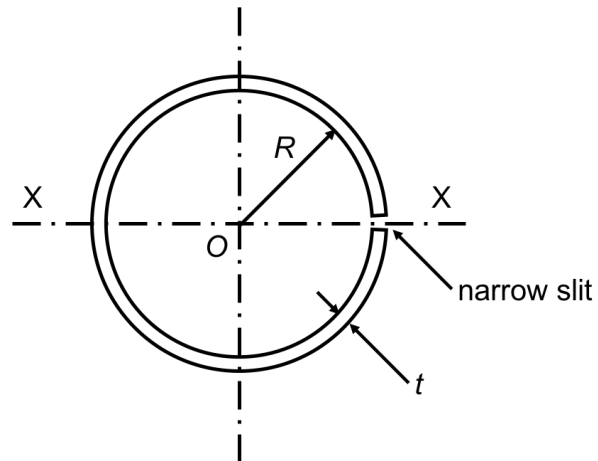


Fig. Q7.

[Ans: $2R$ from O along the axis of symmetry X - X , away from the slit]