

MECHANICS (ME10001)

Tutorial 11: Bending Stresses

1. The maximum fiber stress at a certain section in a rectangular beam 100 mm wide and 200 mm deep is 12 MPa. Determine (a) the resisting moment M , in the beam at that section; (b) the percentage decrease in this moment if the dotted central portion of the beam is removed (Fig.1).
[Ans: 8 kN, 21.1%]

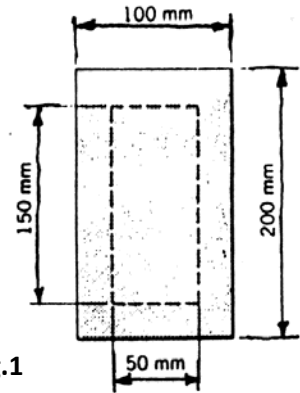


Fig.1

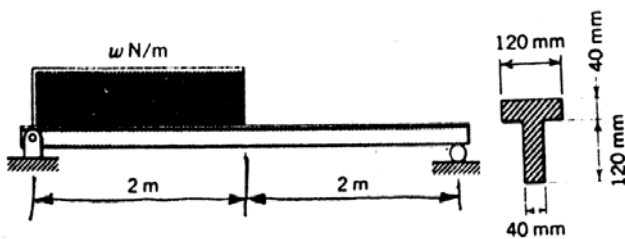


Fig. 2

2. A beam is loaded and supported as shown in Fig.2. If the allowable fiber stresses on a section at the middle of the span are 15 MPa (Tension) and 10 MPa (Compression), determine the maximum permissible value of the load.
[Ans: 3.26 kN/m]

3. The beam shown in Fig.3(a) has cross section shown in Fig.3(b). Determine (a) the maximum tensile fiber stress in the beam and (b) the maximum compressive fiber stress in the beam.

[Ans. 64.6 MPa, 93.8 MPa]

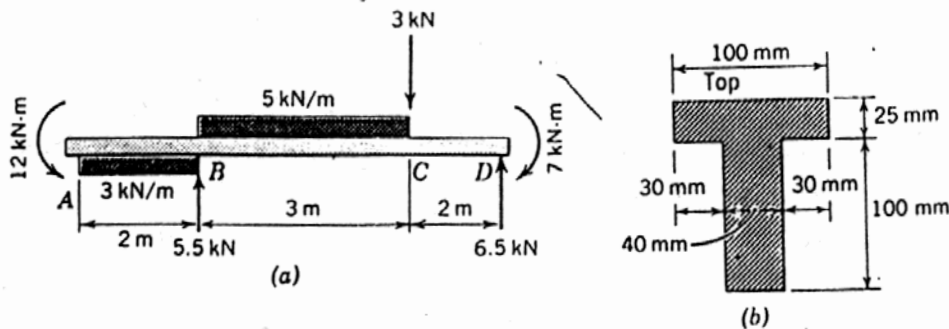


Fig.3

4. A rectangular beam having width 150 mm and depth 250 is simply supported over a span of 5 m. What uniformly distributed load it can carry if the maximum permissible bending stress is 120 MPa? What concentrated load can be put at the mid span instead?
[Ans. 60 kN/m, 150 kN]
5. A steel rule having width 40 mm and depth 1 mm is bent along its 400 mm length by couples applied at ends to make it a circular arc of 60° . Determine the maximum bending stress induced into the member, $E=200$ GPa.
[Ans. 261.8 N/mm²]

6. A cast iron water pipe 450 mm in diameter having thickness 18 mm is supported on a span of 7 meters. Determine the maximum bending stress in the material of the pipe when the pipe is running full, taking unit weight of cast iron as 70 kN/m^3 and that of water as 10 kN/m^3 respectively.
[Ans. 6.01 MPa]
7. A rectangular section is to be cut from a circular log of wood of diameter 600 millimeter. Determine the strongest rectangular section of a beam which can be made from this circular log.
[Ans. width= 346.4 mm, depth = 489.9 mm]
8. Two circular beams- one solid and another hollow are equally strong in bending. If the inside diameter of the hollow section is $\frac{3}{5}$ th of its external diameter, determine how much heavier the solid section is as compared to the hollow section?
[Ans. 42.5% heavier]
9. For a given allowable bending stress, compare the moment of resistance of a square beam placed with (a) its side horizontal (b) with one of its diagonal horizontal.
[Ans. The square beam is 41.4% stronger with its sides horizontal]
10. A beam of square cross section is placed with one of its diagonal in vertical position. Show that the bending strength can be increased by chipping off portion of the beam at top and bottom, making the cross section hexagonal. Calculate the depth of chipping with respect to the original depth and also compute the percentage gain.
[Ans. $a=h/9$, maximum gain 5.35%]