53 (CE 302) STMT

2019

STRENGTH OF MATERIALS

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

Answer ***any five*** *questions out of* ***six.***

1. An element in a strained body is subjected to a tensile stress of 150 *MPa* and a shear stress of 50 *MPa* tending to rotate the element in an anticlockwise direction. Find:

   (i) The magnitude of the normal and shear stresses on a section inclined at 40° with the tensile stress, and

   (ii) The magnitude of maximum shear stress that can exist on the element.

   20

2. An alloy circular bar *ABCD*, 3 *m* long is subjected to a tensile force of 50 *kN* as shown in *Figure* 1. If the stress in the middle portion *BC* is not to exceed 150 *MPa*, then what should be its diameter ? Also find the length of the middle section, if the total extension of the bar should not exceed by 3 *mm*. Take *E* as 100 *GPa*. 20

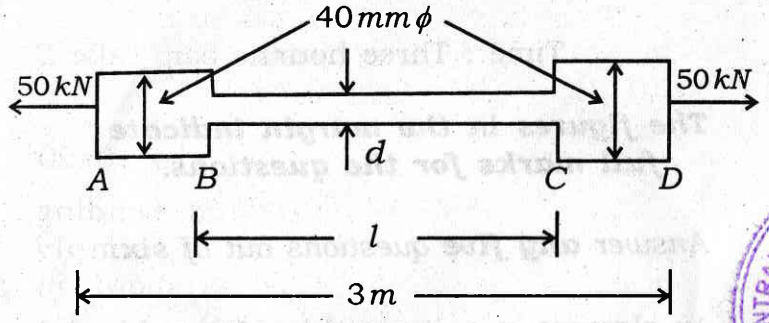

Figure 1

3. 10+10=20

(a) A hollow steel tube 4 *m* long has external diameter of 80 *mm*. In order to determine the internal diameter, the tube was subjected to a tensile load of 300 *kN* and extension was measured to be 2·5 *mm*. If the modulus of elasticity for the tube material is 100 *GPa*, determine the internal diameter of the tube.

(b) A steel bar *ABCD* 4 *m* long is subjected to force as shown in *Figure* 2.

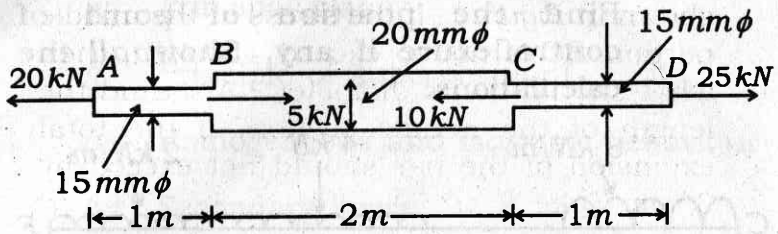

Figure 2

Find the elongation of the bar. Take *E* for the steel as 200 *GPa*.

4. 10+10=20

(a) Draw the shear force and bending moment diagrams for a simply supported beam, loaded as shown in *Figure* 3.

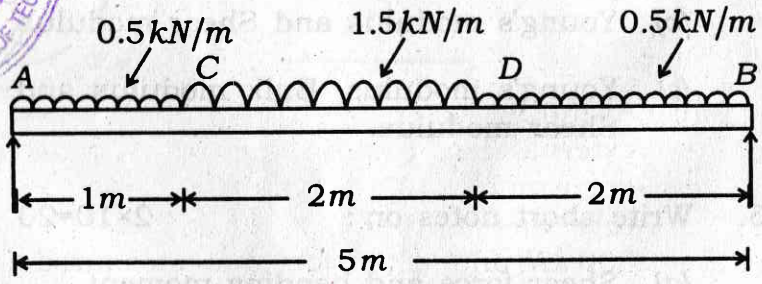

Figure 3

Find the position and value of the maximum bending moment that will occur in the beam.

(b) Draw the SFD and BMD for the overhanging beam shown in *Figure* 4. Find the position of point of contraflexure if any. Show *all* the calculations.

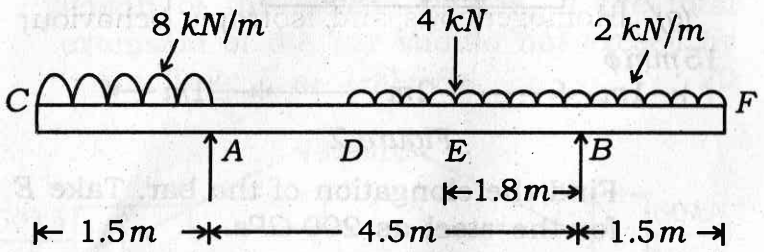

Figure 4

5. Derive the relationship between : 5+5+10=20

(a) Young's modulus and Bulk modulus

(b) Young's modulus and Shear modulus

(c) Young's modulus, Bulk modulus and Shear modulus.

6. Write short notes on : 2×10=20

(a) Shear force and bending moment

(b) Bulk modulus

(c) Modulus of elasticity

(d) Modulus of rigidity

(e) Principal plane

(f) Principle of superposition

(g) Homogeneous and isotropic behaviour

(h) Secondary strain

(i) Types of stresses

(j) Point of contraflexure.