53 (CE 302) STMT

2019

STRENGTH OF MATERIALS

Paper : CE 302

Full Marks : 100

Time : Three hours

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

Answer Question No. **1** *and* ***any four*** *from the remaining part.*

1. Write short notes on the following : 10×2=20

   (i) Shear force and bending moment

   (ii) Principle of Superposition

   (iii) Secondary strain

   (iv) Principal plane

   (v) Homogeneous and isotropic behaviour

(vi) Modulus of rigidity

(vii) Types of stresses

(viii) Bulk modulus

(ix) Point of contraflexure

(x) Modulus of elasticity.

2. Derive the relationship between modulus of elasticity, modulus of rigidity and bulk modulus. 20

3. (a) A simply supported beam with overhang is subjected to load as shown in *Fig.* 1. Draw its shear force and bending moment diagrams. Find the location of point of contraflexure, if any. 10

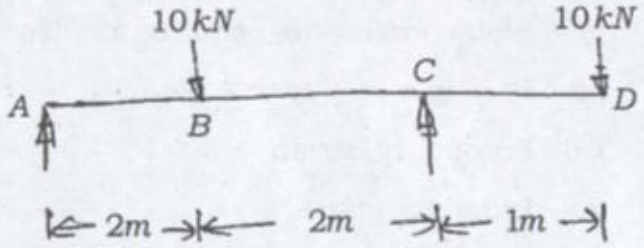

Fig. 1

(b) A simply supported beam *AB*, 6*m* long is loaded as shown in *Fig.* 2. Draw the shear force and bending moment diagrams for the beam. Show all the calculations. 10

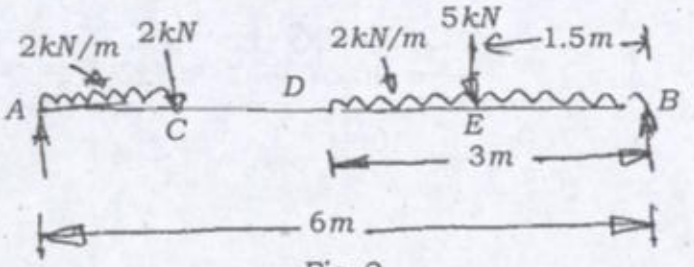

Fig. 2

4. The principal stresses at a point in the section of a member are 50 *MPa* and 20 *MPa* both tensile. If there is a clockwise shear stress of 30 *MPa*, find graphically the normal and shear stresses on a section inclined at an angle 15° with the normal to the major tensile stress. Also write the steps of construction. 20

5. (a) A hollow steel tube 3.5 *m* long has external diameter of 100 *mm*. In order to determine the internal diameter, the tube was subjected to a tensile load of 400 *kN* and extension was measured to be 2 *mm*. If the modulus of elasticity for the tube material is 200 *GPa*, determine the internal diameter of the tube. 10

(b) A steel bar of 600 mm^2 cross-sectional area is carrying loads as shown in *Fig.* 3. Determine the elongation of the bar. Take E for the steel as 200 *GPa*. 10

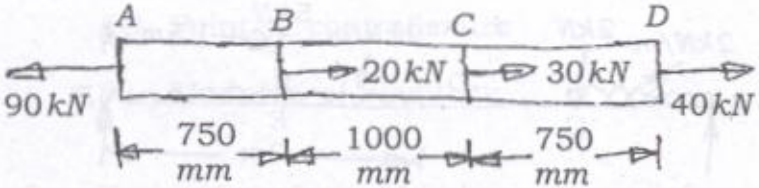

Fig. 3

6. An alloy circular bar *ABCD*, 3*m* long is subjected to a tensile force of 50 *kN* as shown in *Fig.* 4. 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

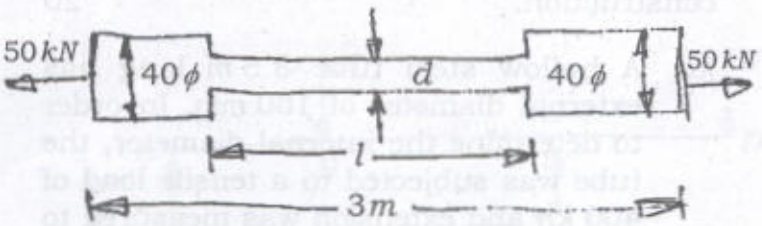

Fig. 4