53 (CE 302) STMT

2014

STRENGTH OF MATERIALS

Paper : CE 302

Full Marks : 100

Time : Three hours

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

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

1. A simply supported beam with over-hanging ends carries transverse loads as shown in *Fig.-1*

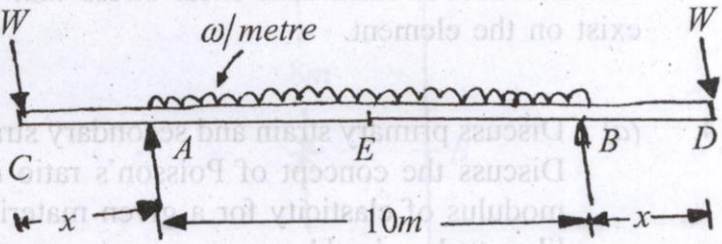

Fig.-1

If $W = 10\omega$, what is the overhanging length on each side, such that bending moment at the middle of the beam, is zero ? Sketch the shear force and bending moment diagrams. Also show all the calculations. 20

Contd.

2. *(a)* Define and also explain the concept of theory of simple bending. Also list out the assumptions made in the theory of simple bending. 2+4+3

(b) Discuss modulus of section for a given section of beam. Also discuss its significance. Derive the equation for the theory of simple bending. 2+2+7

3. 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 and direction of maximum shear stress that can exist on the element. 20

4. *(a)* Discuss primary strain and secondary strain. Discuss the concept of Poisson's ratio and modulus of elasticity for a given materials, like steel and rubber. 10

(b) In case of a rectangular body subjected to an Axial force show that $\frac{\delta v}{V} = e\left(1 - \frac{2}{m}\right)$, where symbols have their usual meaning. 10

5. Two wooden planks $150mm \times 50mm$ each are connected to form a *T*-section of a beam. If a moment of $6{\cdot}4kNm$ is applied around the horizontal neutral axis, inducing tension below the neutral axis, find the bending stresses at both the extreme fibres of the cross-section. 20

6. *(a)* A steel wire *ABC* $16m$ long having cross-sectional area of $4mm^2$ weighs $20N$ as shown in *Fig.-2*. If the modulus of elasticity for the wire material is $200Gpa$, find the deflections at *C* and *B*. 14

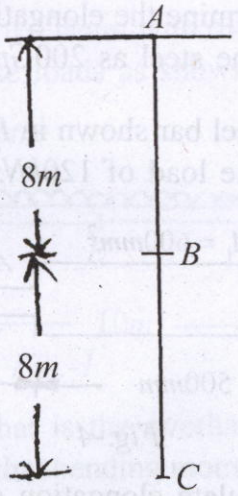

Fig.-2

(b) Derive for the deformation of a body due to force acting on it, with the use of usual notations and symbols wherever applicable. 6

7. (a) A steel bar of $600mm^2$ cross-sectional area is carrying loads as shown in *Fig-3*.

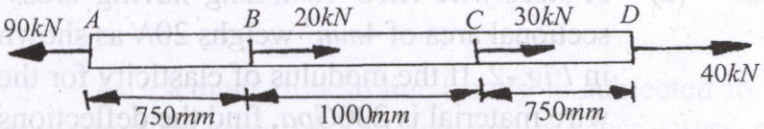

Fig.-3

Determine the elongation of the bar. Take E for the steel as $200Gpa$. 10

(b) A steel bar shown in *Fig.4* is subjected to a tensile load of $120kN$.

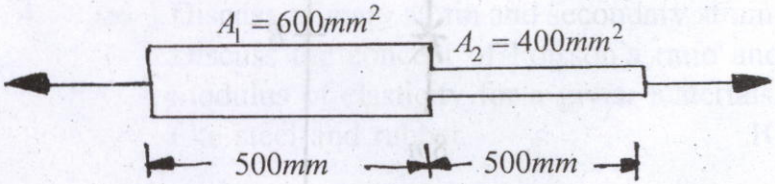

Fig.-4

Calculate elongation of the bar. Take E as $200Gpa$. 10
