53 (CE 302) STMT

2018

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)* A cantilever beam of 1·5*m* span is loaded as shown in *Fig. 01*. Draw the shear force and bending moment diagrams. Show all the SF and BM calculations. 10

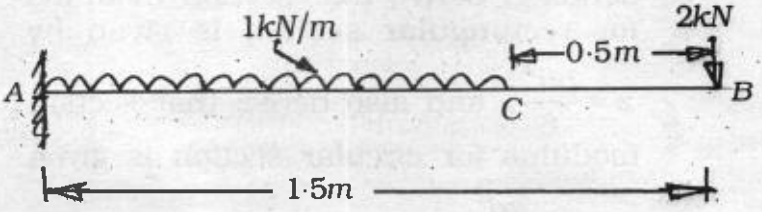

Fig. 01

(b) A simply supported beam of $4m$ span is carrying loads as shown in *Fig. 02*. Draw the shear force and bending moment diagrams for the beam. Show all the SF and BM calculations. 10

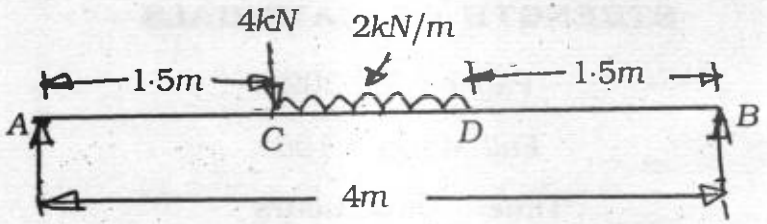

Fig. 02

2. (a) A rectangular beam $60mm$ wide and $150mm$ deep is simply supported over a span of $4m$. If the beam is subjected to a uniformly distributed load of $4{\cdot}5kN/m$, find the maximum bending stress induced in the beam. 10

(b) For the bending in case of simple bending, derive that section modulus for rectangular section is given by $z = \frac{bd^2}{6}$, and also derive that section modulus for circular section is given by $z = \frac{\pi d^3}{32}$. Where symbols have their usual meaning. 5+5

3. The stresses at a point in a component are 100*MPa* (tensile) and 50*MPa* (compressive). Determine the magnitude of the normal and shear stresses on a plane inclined of an angle of 25° with tensile stress. Also determine the direction of the resultant stress and the maximum intensity of shear stress. 20

4. *(a)* A hollow steel tube 3·5*m* long has external diameter of 120*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 reinforced concrete circular section of 50,000mm^2 cross-sectional area carries 6 reinforcing bars whose total area is 500mm^2. Find the safe load, the column can carry, if the concrete is not to be stressed more than 3·5*MPa*. Take modular ratio for steel and concrete as 18. 10

5. *Fig. 03* shows a rolled steel beam of an unsymmetrical I-section. If the maximum bending stress in the beam section is not to exceed 40*MPa*, find the moment which the beam can resist. 20

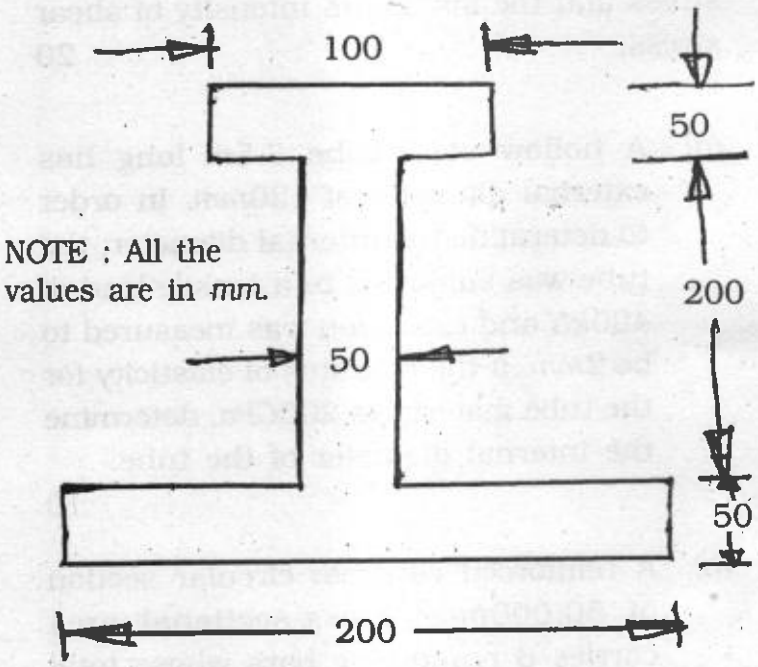

Fig. 03

6. *(a)* A steel bar *ABCD* 4*m* long is subjected to forces as shown in *Fig. 04*. Find the

elongation of the bar. Take E for the steel as $200GPa$. 12

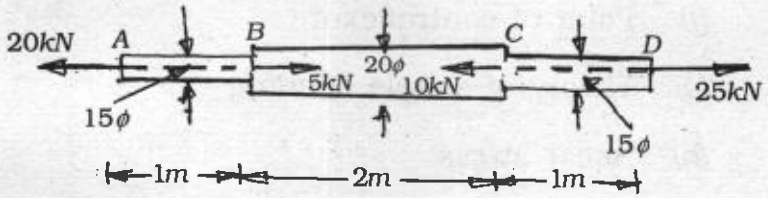

Fig. 04

(b) A steel bar shown in *Fig. 05* is subjected to a tensile force of $120kN$. Calculate the elongation of the bar. Take E as $200GPa$. 8

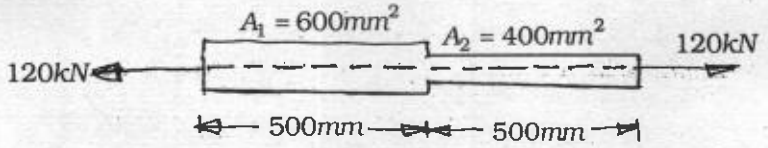

Fig. 05

7. Define and, *Or* describe : 10×2=20

(a) Hooke's law

(b) Poisson's ratio

(c) Linear strain

(d) Lateral strain

(e) Volumetric strain

(f) Point of contraflexure

(g) Theory of simple bending

(h) Shear stress

(i) Significance of SFD and BMD

(j) Importance of centre of gravity.
