2017

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) Draw the S.F and B.M. diagrams for a
cantilever loaded as shown in *Fig. 01*.
Show all the calculations.

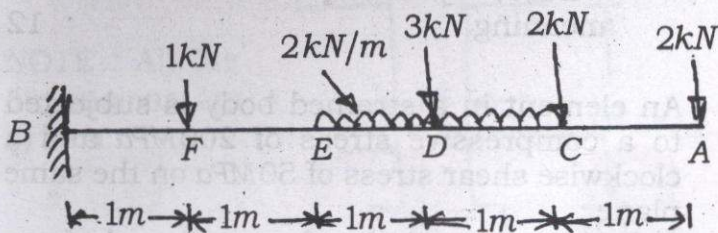*Fig. 01*   10

(b) Draw the shear force and bending moment diagrams for the S.S.B. shown as in *Fig.02*. Show all the calculations.
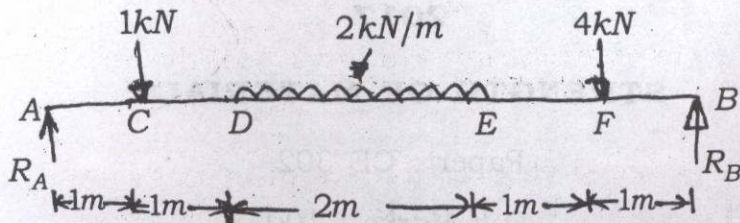

Fig.02

10

2. *(a)* Describe theory of simple bending. Also list out the assumptions made in theory of simple bending.   4+4=8

   (b) For the bending of a simple beam (SSB), derive that

$$\frac{M}{I} = \frac{6}{y} = \frac{E}{R},$$

where, symbols have their usual meaning.   12

3. An element in a strained body is subjected to a compressive stress of 200 *MPa* and a clockwise shear stress of 50 *MPa* on the same plane.
   Calculate the values of normal and shear stresses on a plane inclined at 35° with the compressive stress. Also calculate the value of maximum shear stress in the element.

20

4. (a) Explain how always a linear strain is accompanied by a corresponding lateral strain. 6

(b) In an experiment, a bar of $30mm$ diameter is subjected to a pull of $60kN$. The measured extension on gauge length of $200mm$ is $0.09mm$ and the change in diameter is $0.0039mm$. Calculate the Poisson's ratio and the values of the three moduli. 14

5. The cross-section of a beam is shown in *Fig. 03*. The beam is made of material with permissible stress in compression and tension equal to $100MPa$ and $140MPa$ respectively. Calculate the moment of resistance of the cross-section, when subjected to a moment causing compression at the top and tension at the bottom.
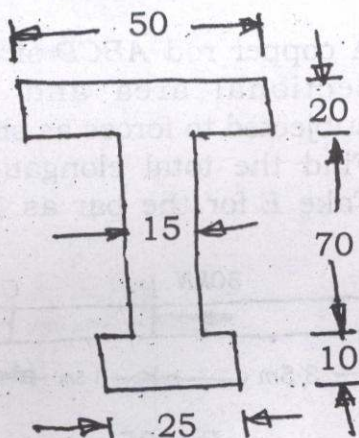
NOTE : All the dimensions are in *mm*.

Fig. 03 20

6. (a) An alloy circular bar *ABCD*, 3*m* long is subjected to a tensile force of 50*kN* as shown in *Fig. 04*. 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 portion, if the total extension of the bar should not exceed by 3*mm*. Take *E* as 100*GPa*.
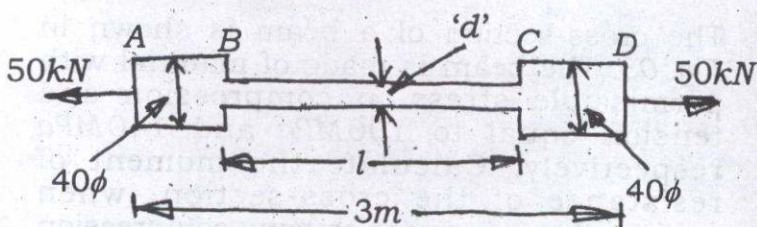

Fig. 04

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(b) A copper rod *ABCD* of 800*mm²* cross-sectional area and 7·5*m* long is subjected to forces as shown in *Fig. 05*. Find the total elongation of the bar. Take *E* for the bar as 100*GPa*.
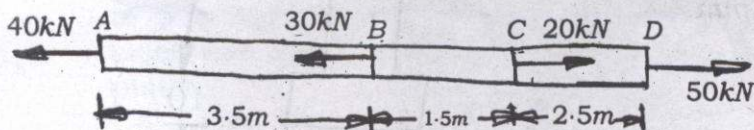

Fig. 05

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7. Write short notes on :   10×2=20

(a) Poisson's ratio

(b) Young's modulus

(c) Section modulus

(d) Bulk modulus

(e) Shear modulus

(f) Linear strain

(g) Lateral strain

(h) Principal plane

(i) Elasticity and Elastic Limit

(j) Hooke's law.

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