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) In an experiment, a bar of 25mm. diameter is subjected to a pull of 60kN. The measured extension on gauge length of 200mm is 0·9mm and the change in diameter is 0·0039mm. Calculate the Poisson's ratio and the values of the three moduli. 14

   (b) "A linear strain is accompanied by a corresponding lateral strain." Explain the statement given above. 6

2. (a) A copper rod ABCD of $750mm^2$ cross-sectional area and $7.5m$ long is subjected to forces as shown in Fig. 01. Calculate the total elongation of the bar. $E = 100GPa$ 6
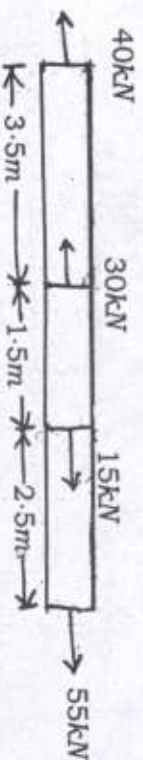

Fig. 01

(b) An alloy circular bar ABCD, 3m long is subjected to a tensile force of 50kN as shown in Fig. 02. If the stress in the middle portion BC is not to exceed 150MPa, 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 3mm. Take $E = 100GPa$. 14
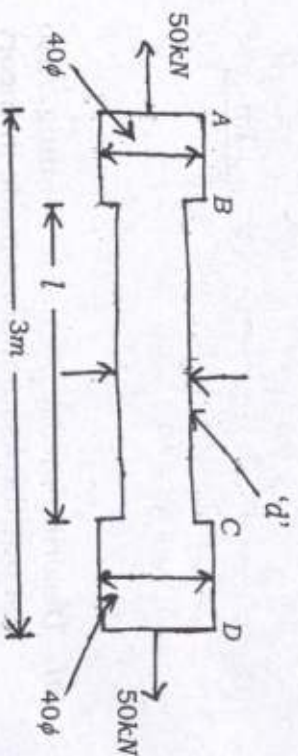

Fig. 02

3. (a) Draw the S.F. and B.M. diagrams for a cantilever loaded as shown in Fig. 03. Show all the calculations. 10
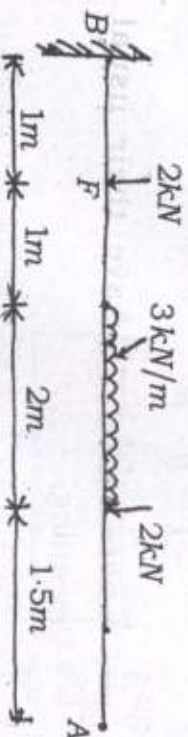

Fig. 03

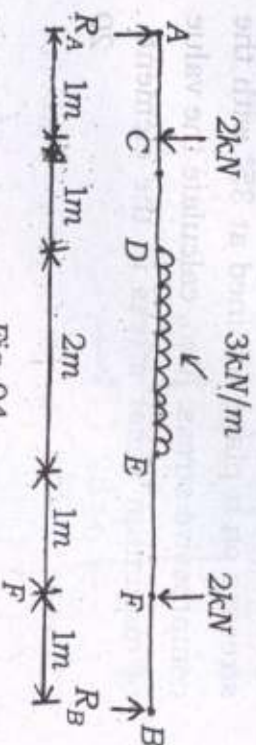(b) Draw the shear force and bending moment diagrams for the S.S.B. shown as in Fig. 04. Show all the calculations. 10

Fig. 04

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

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

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

where, symbols have their usual meaning. 12

5. An element in a strained body is subjected to a compressive stress of 180 MPa and a clockwise shear stress of 40 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

6. The cross-section of a beam is given in Fig. 05. The beam is made of material with permissible stress in compression and tension equal to 100 MPa and 140 MPa 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. 20
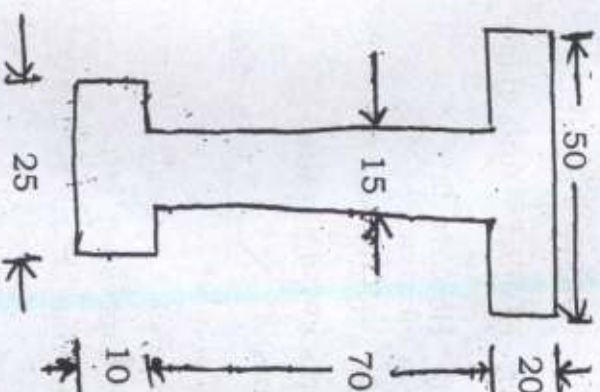
NOTE : All the dimensions are in mm

Fig. 05

7. Write short notes on : 10×2=20

   (a) Modulus of Elasticity

   (b) Bending moment

(c) Poisson's ratio

(d) Bulk modulus

(e) Modulus of rigidity

(f) Principal plane

(g) Elasticity and elastic limit

(h) Hooke's law

(i) Lateral strain

(j) Linear strain.

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