Total No. of printed pages = 5

BES-402/SoM/4th Sem/2017/M

STRENGTH OF MATERIALS

Full Marks – 70

Pass Marks – 28

Time – Three hours

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

Answer any *five* questions.

1. (a) Define Poisson's ratio. 2

   (b) What are the different types of loads acting on a beam ? 3

   (c) Define principal stress and principal plane. 4.

   (d) What is bulk modulus of material ? 2

   (e) Write short note on types of springs. 3

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2. (a) Mention the assumptions made in the theory of simple bending. 4

(b) Derive a relation for the volumetric strain of a body. 10

3. (a) Explain the difference between 'primary strain' and 'secondary strain'. 4

(b) In an experiment, a steel specimen of 13 mm diameter was found to elongate 0.2 mm in a 200 mm gauge length when it was subjected to a tensile force of 26.8 kN. If the specimen was tested within the elastic range, what is the value of Young's modulus for the steel specimen ? 5

(c) An alloy bar 1m long and 200 mm^2 in cross-section is subjected to a compressive force of 20 kN. If the modulus of elasticity for the alloy is 100 GPa, find the decrease in length of the bar. 5

4. (a) A copper rod ABCD of 800 mm^2 cross-sectional area and 7.5 m long is subjected to

forces as shown in fig (i)

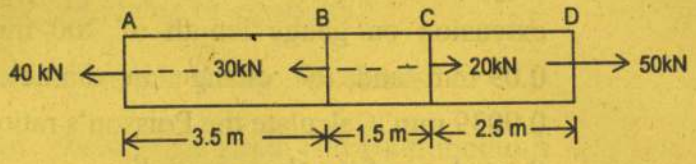

fig (i)

Find the total elongation of the bar. Take E for the bar material as 100 GPa. 7

(b) An alloy bar 800 mm long and 200 mm^2 in cross-section is held between two rigid plates and is subjected to an axial load of 200 kN as shown in fig (ii). Find the reactions at the two ends A and C as well as extension of the portion AB. 7

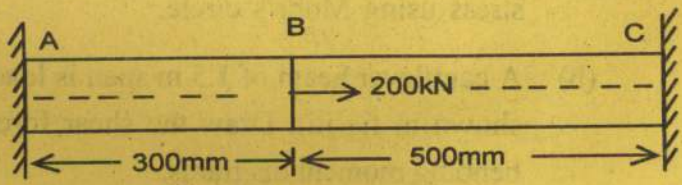

fig (ii)

5. (a) A steel bar 50 mm × 50 mm in cross-section is 1.2m long. It is subjected to an axial pull of 200 kN. What are the changes in length, width and volume of the bar, if the value of Poisson's ratio is 0.3 ? Take E as 200 GPa. 7

(b) In an experiment, a bar of 30 mm diameter is subjected to a pull of 60kN. The measured extension on gauge length of 200 mm is 0.09 mm and the change in diameter is 0.0039 mm. Calculate the Poisson's ratio and the values of the three moduli. 7

6. (a) 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 at an angle of 25° with tensile stress. Also determine the direction of the resultant stress and the magnitude of the maximum intensity of shear stress using Mohr's circle. 7

(b) A cantilever beam of 1.5 m span is loaded as shown in fig(iii). Draw the shear force and bending moment diagrams. 7

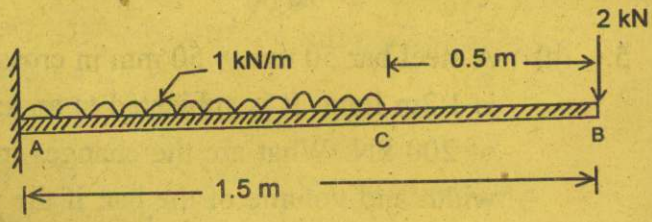

fig (iii)

7. Write short notes on any *four* : $4 \times 3.5 = 14$

(a) Modulus of elasticity

(b) Principle of superposition

(c) Volumetric strain and Bulk modulus

(d) Torsion of circular shaft

(e) Relationship between shear force and bending moment.