

Total No. of printed pages = 4

19/4th Sem/UCE 402

2022

## STRENGTH OF MATERIALS

Full Marks – 100

Time – Three hours

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

Answer any *five* questions.

1. (a) Define point of contraflexure with the help of a sample diagram. 5
- (b) Write the principles of superposition. 5
- (c) Distinguish between Lateral strain and Linear strain. 5
- (d) State the differences between Torque and Bending moment. 5
2. (a) A hollow cylinder 2m long has an outside diameter of 50 mm and inside diameter of 30 mm. If the cylinder is carrying a load of 25 kN, find the stress in the cylinder. Also find the deformation of the cylinder, if the value of modulus of elasticity for the cylinder material is 100 GPa. 6

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(b) A hollow steel tube 3.5m 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.

7

(c) Two wires, one of steel and the other of copper, are of the same length and are subjected to the same tension. If the diameter of the copper wire is 2 mm, find the diameter of the steel wire, if they are elongated by the same amount. Take  $E$  for steel as 200 GPa and that for copper as 100 GPa.

7

3. (a) An alloy circular bar ABCD 3m long is subjected to a tensile force of 50 kN as shown in fig. 1. All the diameters are in mm.

10

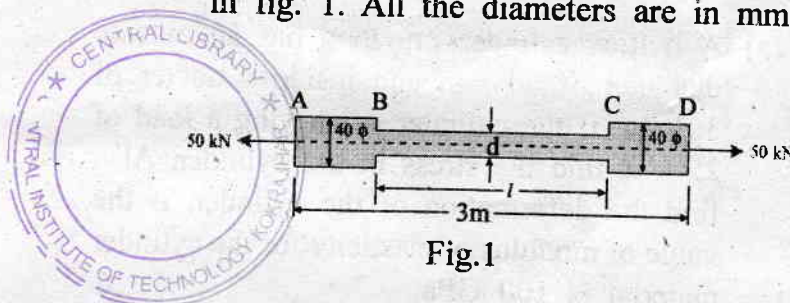


Fig.1

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(2)

- (b) A steel bar ABCD 4m long is subjected to forces as shown in fig. 2. All the diameters are in mm. 10

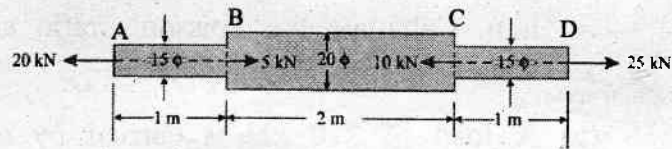


Fig.2

4. (a) Draw the complete shear force diagram for the overhanging beam shown in fig. 3. Show all the calculations. 10

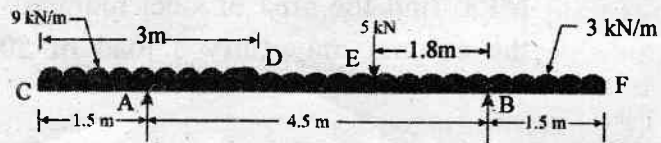


Fig. 3

- (b) Draw shear force and bending moment diagrams for a simply supported beam, loaded as shown in fig. 4 10

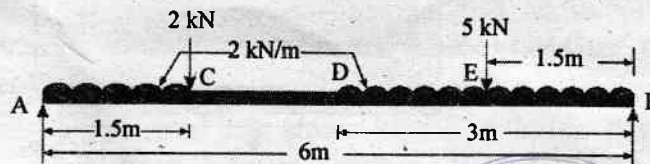
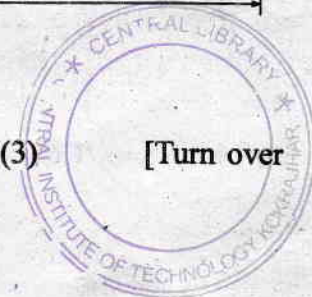
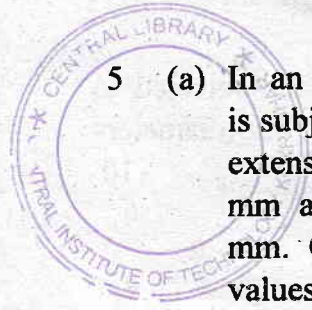


Fig.4





5 (a) In an experiment, a bar of 30 mm diameter is subjected to a pull of 60 kN. 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. 10

(b) A load of 270 kN is carried by a short concrete column 250 mm × 250 mm in size. The column is reinforced with 8 bars of 16 mm diameter. Find the stresses in concrete and steel, if the modulus of elasticity for the steel is 18 times that of concrete. If the stress in concrete is not to exceed 5 MPa, find the area of steel required, so that the column may carry a load of 500 kN. 10

6. A point in a strained material is subjected to the stresses as shown in fig. 5. Find graphically, or otherwise, the normal and shear stresses on the section AB. 20

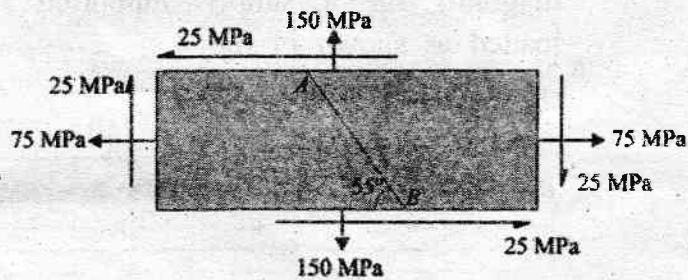


Fig.5