Total number of printed pages: 04 **Program (UG)/4th/UCE402**

2024

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. Define/elaborate/differentiate:

   (i) Elasticity, Elastic limit, stress, strain and Hooke's Law 5×1=5

   (ii) Differentiate between linear strain and lateral strain with proper diagram as applicable. 5

   (iii) What are the moduli of elasticity. Define each of them 5

   (iv) Explain/describe theory of simple bending with proper diagram as applicable 5

2. An element in a strained body is subjected to a tensile stress of 150 Mpa and an anticlockwise shear stress of 50 Mpa. Find (i) The magnitude of the normal and shear stresses on a section inclined at 40° with the tensile stress. (ii) Magnitude of resultant stress and maximum shear stress that can exist on the element. 20

3. (i) A member ABCD is subjected to point load as shown in figure 1. Determine the total change in length of the member. Take E=200 GPa. All the lengths are in mm. 10

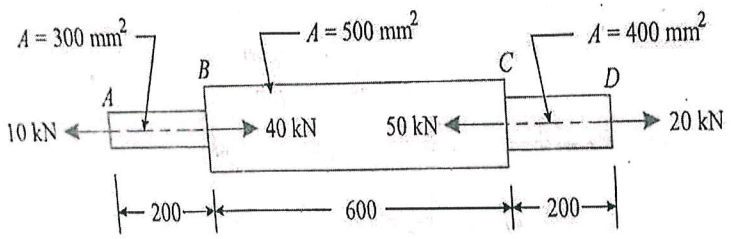

Fig.1

(ii) A copper bar shown in figure 2 is subjected to a tensile load of 30 kN. Determine the elongation of the bar, if E=100 Gpa 10

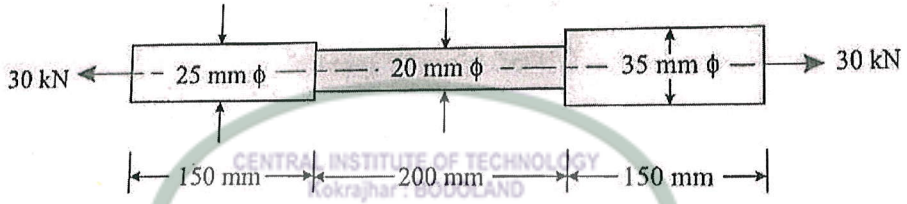

Fig.2

4 a) A hollow cylinder 2 m 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

b) 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. 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

5 a) Draw the shear force and bending moment diagrams for the overhanging beam shown in fig. 3. Show all the calculations. 10

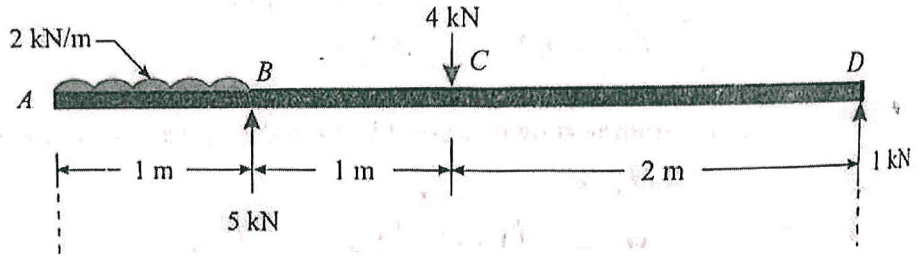

Fig.3

b) Draw the shear force and bending moment diagrams for the simply supported beam, loaded as shown in fig. 4. Show all the calculations. 10

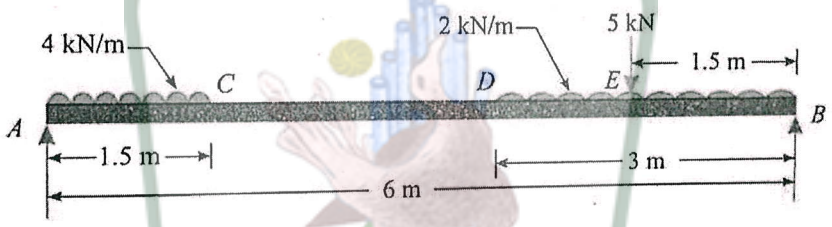

Fig.4

6 a) A hollow steel tube having external and internal diameter of 100 mm and 75 mm respectively is simply supported over a span of 5 m. The tube carries a concentrated load of W at a distance of 2 m from one of the supports. What is the value of W, if the maximum bending stress is not to exceed 100 MPa. 10

b) A reinforced concrete circular section of 50,000 mm^2 cross-sectional area carries 6 reinforcing bars whose total area is 500 mm^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

THE END


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