Total No. of printed pages = 5

BES-402/SOM/4th Sem/2013/N/C

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) Fill up the blanks : 1×6=6

(i) If a force acts on a body, it sets up some resistance to the deformation. This resistance is known as ——.

(ii) The term deformation per unit length is applied for ——.

(iii) Modulus of elasticity is the ratio of ——.

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(iv) The ratio of lateral strain to the linear strain is called ——.

(v) The bulk modulus of a body is equal to ——.

(vi) Torque transmitted by a solid shaft of diameter (D), when subjected to a shear stress (τ) is equal to ——.

(b) Define the term 'beam'. 2

(c) Define the terms shear force and bending moment. 4

(d) What do you mean by 'Poisson's ratio'? 2

2. (a) State clearly the Hooke's law. 2

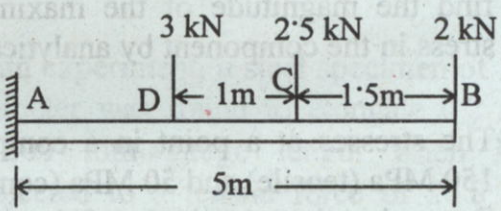
(b) A hollow steel tube 3·5m long has external diameter of 120 mm. In order to determine the internal diameter, the tube was subjected to a tensile load of 400 kN and extension was measured to be 2 mm. If the modulus of elasticity for the tube material is 200 GPa, determine the internal diameter of tube. 6

(c) A steel bar 2m long and 150 mm^2 in cross-section is subjected to an axial pull of 15 kN. Find the elongation of the bar. Take E = 200 GPa. 5

(d) Define the term 'elasticity'. 1

3. (a) A copper rod, circular in cross-section, uniformly tapers from 40 mm to 20 mm in a length of 11m. Find the magnitude of force, which will deform it by 0·8 mm. Take E = 100 GPa. 5

(b) Draw shear force and bending moment diagrams for a cantilever beam of span 5m carrying point loads as shown in figure. 6



(c) A circular bar 2·5m long tapers uniformly from 25 mm diameter to 12 mm diameter. Determine extension of the rod under a pull of 30 kN. Take E = 200 GPa. 3

4. (a) A metal bar 50 mm × 50 mm in section is subjected to an axial compressive load of 500 kN. If the contraction of a 200 mm gauge length was found to be 0·5 mm and the increase in thickness 0·04 mm, find the values of Young's modulus and Poisson's ratio for the bar material. 7

(b) In an experiment an alloy bar 1m long and 20 mm × 20 mm in section was tested to increase through 0·1 mm, when subjected to an axial tensile load of 6·4 kN. If the value of bulk modulus for the bar is 133 GPa, find the value of Poisson's ratio. 7

5. (a) The stresses at point of a machine components are 200 MPa and 100 MPa both tensile. Find the intensities of normal, shear and resultant stresses on a plane inclined at an angle of 50^{o} with the axis of major tensile stress. Also find the magnitude of the maximum shear stress in the component by analytical method. 7

(b) The stresses at a point in a component are 150 MPa (tensile) and 50 MPa (compressive). Determine the magnitude of the normal and shear stresses on a plane inclined at an angle of 30^{o} with tensile stress. Also determine the direction of the resultant stress and the magnitude of the maximum intensity of shear stress. Solve by using Mohr's circle. 7

6. (a) A solid circular shaft of 230 mm diameter is transmitting 275 kW at 120 r.p.m. Find the intensity of shear stress in the shaft. 7

(b) Derive an equation for the deflection of closely-coiled helical springs. 7

7. (a) A steel bar 2m long, 40 mm wide and 20 mm thick is subjected to an axial pull of 140 kN in the direction of its length. Find the changes in length, width and thickness of the bar. Take E = 200 GPa and Poisson's ratio = 0·3. 7

(b) A steel rod 2m long and 25 mm × 25 mm in cross-section is subjected to a tensile force of 50 kN. Determine the elongation of the rod, if modulus of elasticity for the rod material is 200 GPa. 3

(c) 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 ? 4