Total No. of printed pages = 4

BES-402/SM/4th Sem/2013/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 the term 'strength' of the material. 2

   (b) Define stress, strain and elasticity. 5

   (c) State clearly Hooke's law. 2

   (d) Explain the difference between 'primary strain' and 'secondary strain. 2

   (e) Define Poisson's ratio. 3

2. (a) Define volumetric strain and bulk modulus. 3

   (b) What do you mean by beam ? Define shear force and bending moment. 1+3=4

[Turn over

(c) 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

3. (a) A steel rod 1m long and 20 mm × 20 mm in cross-section is subjected to a tensile force of 40 kN. Determine the elongation of the rod, if the modulus of elasticity for the rod material is 200 GPa. 3

(b) 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 E = 100 GPa. 7

(c) A load of 5 kN is to be raised with the help of a steel wire. Find the minimum diameter of the steel wire, if the stress is not to exceed 100 MPa. 4

4. (a) 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. 4

(b) 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 = 200 GPa. 10

5. (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°. Also find the resultant stress and magnitude of maximum intensity of shear stress. 7

(b) The stresses at a point of a machine component are 150 MPa and 50 MPa both tensile. Find the intensities of normal, shear and resultant stresses on a plane inclined at an angle of 55° with the axis of major tensile stress using Mohr's circle. 7

6. (a) Draw shear force and bending moment diagrams for a cantilever beam of span 1.5m carrying point loads as shown in fig (i). 7

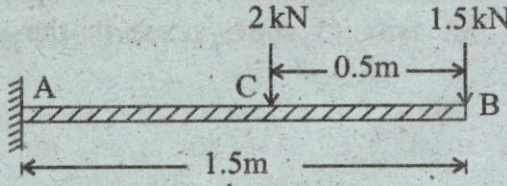
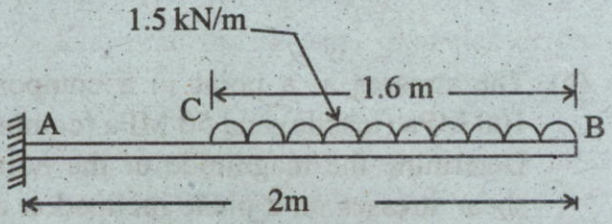


Fig. (i)

(b) A cantilever beam AB, 2m long carries a uniformly distributed load of 1.5 kN/m over a length of 1.6m from free end. Draw shear force and bending moment diagrams for the beam. 7



7. (a) A close-coiled helical spring is required to carry a load of 150 N. If the mean coil diameter is to be 8 times that of the wire, calculate these diameters. Take maximum shear stress as 100 MPa. 5

(b) A circular shaft of 80 mm diameter is required to transmit torque in a factory. Find the torque, which the shaft can transmit, if the allowable shear stress is 50 MPa. 4

(c) A solid circular shaft of 100 mm diameter is transmitting 120 kW at 150 r.p.m. Find the intensity of shear stress in the shaft. 5