BES-402/SOM/4th Sem/2015/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) What do you mean by strength of materials?

    2

    (b) Define force.   2

    (c) State Triangle law of forces and Polygon law of forces.   4

    (d) Define stress. Give the classification of stress.

    3

    (e) Show that steel is more elastic than rubber.

    3

2. (a) 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

(b) A hollow cylinder 4m long has outside and inside diameter of 75 mm and 60 mm respectively. Find the stress and deformation of the cylinder when it is carrying an axial tensile load of 50 kN. Take E = 100 GPa. 7

(c) What is the principle of superposition ? 2

3. (a) A brass rod 1.5m long and 20 mm diameter was found to deform 1.9 mm under a tensile load of 40 kN. Calculate the modulus of elasticity of the rod. 4

(b) An alloy wire of $2 \, mm^2$ cross-sectional area and 12N weight hangs freely under its own weight. Find the maximum length of the wire, if its extension is not to exceed 0.6 mm. Take E for the wire material as 150 GPa. 3

(c) A steel bar of 600 mm² cross-sectional area is carrying loads as shown in figure (i). Determine the elongation of the bar. Take E for the steel as 200 GPa.　　　7
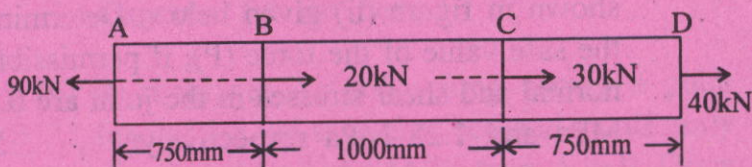

Fig (i)

4. (a) Determine the changes in length, breadth and thickness of a steel bar 4m long, 30 mm wide and 20 mm thick, when subjected to an axial pull of 120 kN in the direction of its length. Take E = 200 GPa and Poisson's ratio is 0.3.

6

(b) A steel bar 1.2m long, 50 mm wide and 40 mm thick is subjected to an axial pull of 150 kN in the direction of its length. Determine the change in volume of the bar. Take m = 4 and E = 200 GPa.　　　4

(c) What is the value of modulus of rigidity of a steel alloy, if its modulus of elasticity is 180 GPa and Poisson's ratio is 0.25 ?　　4

5. (a) What do you mean by principal planes and principal stress ? 3

(b) A tension member is formed by connecting two wooden members 200 mm×100 mm as shown in figure (ii) given below. Determine the safe value of the force (P), if permissible normal and shear stresses in the joint are 0.5 MPa and 1.25 MPa respectively. 5
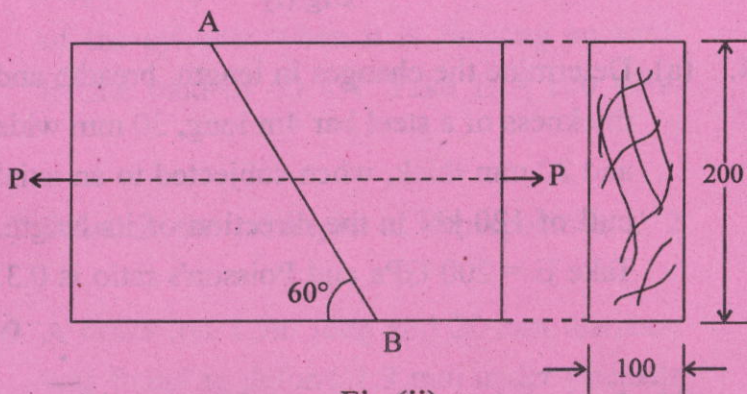

Fig (ii)

(c) The stresses at a point in a component are 100 MPa (tensile) and 50 MPa (compressive). By using Mohr's circle, 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. 6

6. (a) A cantilever beam 1.5m long carries point load of 1 kN, 2 kN and 3 kN at 0.5m, 1m and 1.5m from the fixed end respectively. Draw the shear force and bending moment diagrams for the beam. 7

   (b) A cantilever AB 1.8m long carries a point load of 2.5 kN at its free end and a uniformly distributed load of 1 kN/m from A to B. Draw the shear force and bending moment diagrams for the beam. 7

7. (a) What do you mean by the term 'torsion' ? 2

   (b) A hollow shaft has to transmit 53 kW at 160 rpm. If the maximum shear stress is 50 MPa and internal diameter is half of the external diameter, find the diameter of the shaft. 6

   (c) Define Poisson's ratio. Explain the difference between primary strain and secondary strain. 2+3=5

   (d) Explain clearly the term modulus of rigidity. 1