B.Tech. MECHANICAL ENGINEERING
(COMPUTER INTEGRATED MANUFACTURING)
BTCLEVI / BTMEVI / BTELVI / BTCSVI / BTECVI

Term-End Examination

00903

December, 2016

BME-017 : STRENGTH OF MATERIALS

Time : 3 hours   *Maximum Marks : 70*

Note : *Answer any **seven** questions. All questions carry equal marks. Use of scientific calculator is permitted. Assume suitable data, if any.*

1. Calculate the total elongation of the stepped bar as shown in Figure 1. Take elastic modulus of the material as 60 kN/mm^2. *10*

750 kN

$\phi = 200$ mm $\phi = 135$ mm $\phi = 60$ mm $\phi = 100$ mm

750 kN

├─ 300 ─┤├── 400 ──┤├200┤├── 500 ──┤
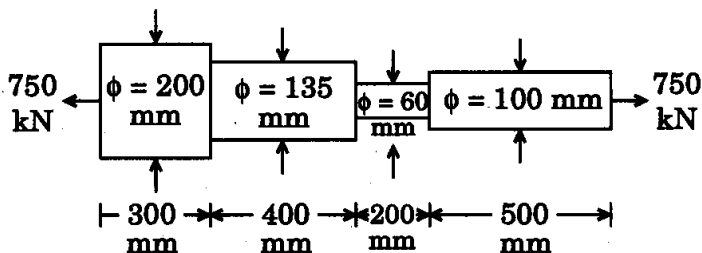mm   mm   mm   mm

Figure 1

2. A composite rod is made by joining a copper rod end to end with a second rod of different material but of same cross-section. At 25°C, the composite rod is 1 m in length of which the length of copper rod is 30 cm. At 125°C, the length of the composite rod increases by 1·91 mm. When the composite rod is not allowed to expand by holding it between two rigid walls, it is found that the length of constituents does not change with rise in temperature. Find the Young's modulus and coefficient of linear expansion of the second rod. For copper $\alpha = 1·7 \times 10^{-5}$ °C^{-1}, and $Y = 1·3 \times 10^{11}$ N/m^2. *10*

3. When a concentrated force of 1 kN is applied at the midspan point of a simply supported beam, a static deflection of 5 mm is produced. The same load produces a maximum stress of 158 MN/m^2. Determine the magnitude of the instantaneous stress produced when a weight of 10 kg is allowed to fall through a height of 12 mm onto the beam at midspan. What will be the instantaneous deflection ? *10*

4. A 12 m span simply supported beam is carrying a uniformly distributed load of 2 kN/m over a length of 6 m from the left end and point loads 6 kN, 3 kN and 4 kN at distances of 7 m, 8 m and 9 m, respectively. Draw the SF diagram and BM diagram for the beam and find the maximum bending moment. *10*

5. An I-section as shown in Figure 2 is used as a beam. The beam is subjected to a bending moment of 2·5 kNm at its neutral axis. Find the maximum stress developed in the beam.   *10*
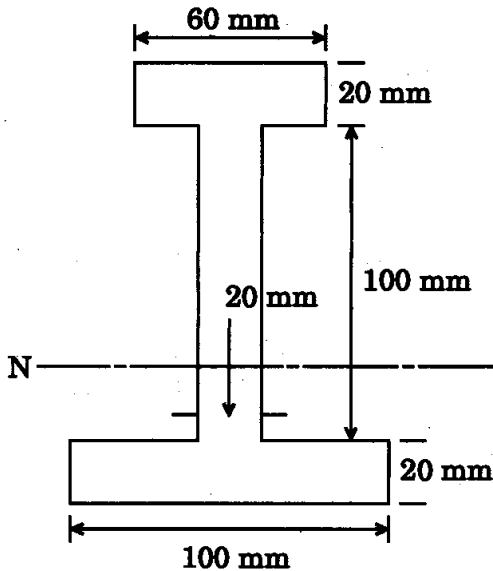

Figure 2

6. A simply supported beam at the ends of span 4 m is subjected to a point load of 20 kN at 1 m from the left support and a uniformly distributed load of 10 kN/m over a length of 2 m from the right support.

   Determine :   *10*

   (a) Slope at the ends

   (b) Maximum deflection

7. A steel bar of 25 mm diameter was tested on a gauge length of 250 cm in tension and in torsion. A tensile load of 50 kN produced an extension of 0·13 mm and a torque of 200 N-m produced a twist of 1·2 degree. Determine :   *10*

   (a) Modulus of rigidity

   (b) Modulus of elasticity

   (c) Poisson's ratio

   (d) Bulk modulus

8. Derive the expressions for the radial stress and hoop stress in a thick cylinder.   *10*

9. A close coiled helical spring has a stiffness of 1 kN/m in compression with a maximum load of 50 N and a maximum shearing stress of 150 N/mm^2. The solid length of the spring is 45 mm. Find the wire diameter, mean coil radius and number of coils. Take G = 40 GPa.   *10*

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