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BME-017

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

Term-End Examination

December, 2015

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.*

1. A bar ABCD, 950 mm length, is made up of three parts AB, BC and CD of lengths 250 mm, 450 mm and 250 mm respectively (figure 1). AB and CD are cylindrical, having diameters of 25 mm and 15 mm respectively. The rod BC is square in section 30 mm × 30 mm. The rod is subjected to a pull of 26000 N. Find,
- (i) the stress in three parts of the rod, and

(ii) the extension of the rod.

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Take $E = 2 \times 10^5 \text{ N/mm}^2$.

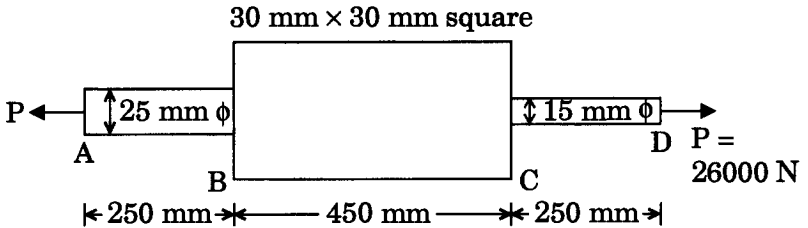


Figure 1

2. A load of 270 kN is applied on a short concrete column 250 mm × 250 mm. The column is reinforced with 8 bars of 16 mm diameter. If the modulus of elasticity for steel is 18 times that of concrete, find the stresses in concrete and steel.

If the stress in concrete does not exceed 4 N/mm^2 , find the area of steel required, so that the column can support a load of 400 kN.

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3. Draw a shear force and bending moment diagrams for the given figure 2.

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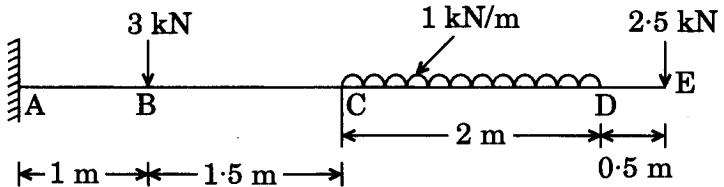


Figure 2

4. A timber beam 250 mm wide and 400 mm deep is strengthened by a steel plate 250 mm wide and 10 mm thick connected to its lower face, so that the overall section is 250 mm \times 410 mm. Determine the stresses in steel and timber, when the beam section is subjected to a sagging bending moment of 75,000 Nm. Assume that Young's modulus for steel is 20 times that for timber. 10
5. At a point in a bracket, the normal stresses on two mutually perpendicular planes are 120 N/mm² tensile and 60 N/mm² tensile. The shear stress across these planes is 30 N/mm². Using the Mohr's stress circle, find the principal stresses and maximum stress at the point. 10
6. A cylindrical air receiver for a compressor is 2 m in internal diameter and made of plates of 12 mm thickness. If the hoop stress is not to exceed 90 N/mm² and the axial stress is not to exceed 60 N/mm², find the maximum safe air pressure. 10
7. A hollow circular shaft 20 mm thick, transmits 300 kW at 200 rpm. Determine the external diameter of the shaft, if the shear strain due to torsion is not to exceed 0.00086. Take modulus of rigidity equal to 8×10^4 N/mm². 10

8. It is required to design a closed coiled helical spring which shall deflect 1 mm under an axial load of 100 N at a shear stress of 90 N/mm^2 . The spring is to be made out of round wire having modulus of rigidity of $8 \times 10^4 \text{ N/mm}^2$. The mean diameter of the coils is to be 10 times the diameter of the wire. Find the diameter and length of the wire necessary to form the spring. 10
9. A uniform beam ($I = 7.8 \times 10^7 \text{ mm}^4$) is 6 m long and carries a central point load of 50 kN. Taking $E = 210 \text{ kN/mm}^2$, calculate the deflection under the load, if
- (a) the beam is simply supported at its ends, and
 - (b) the beam is built-in at one end. 10
10. The moment of inertia of a beam section 500 mm deep is $69.49 \times 10^7 \text{ mm}^4$. Find the longest span over which a beam of this section, when simply supported can carry a uniformly distributed load of 50 kN per meter run. The maximum stress in the material is not to exceed 110 N/mm^2 . 10
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