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BACHELOR OF TECHNOLOGY IN MECHANICAL ENGINEERING (COMPUTER INTEGRATED MANUFACTURING)

BTCLEVI/BTMEVI/BTELVI/BTECVI/BTCSVI

Term-End Examination

December, 2011

BME-017 : STRENGTH OF MATERIALS

Time : 3 hours *Maximum Marks : 70*

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

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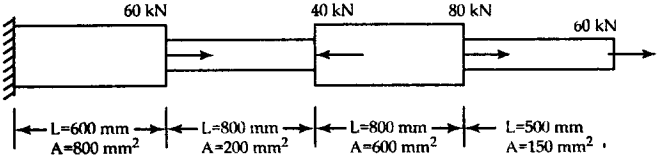
1. A compound tube consists of a steel tube 150 mm internal diameter and 10 mm thickness and on outer brass tube 170 mm internal diameter and 10 mm thickness. The two tubes are of the same length. The compound tube carries an axial load of 1000 kN, find the stresses and the load carried by each tube and the amount it shortens. Length of each tube is 150 mm. Take $E_s = 2 \times 10^5$ N/mm^2 and $E_b = 1 \times 10^5$ N/mm^2. **10**

2. 

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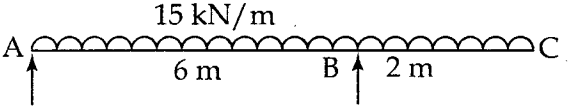
Calculate the total elongation of the bar, taking the elastic modulus, E, as 200 kN/mm^2.

3. The state of stress at a point is given by the stress components $\sigma x = 70$ MPa, $\sigma y = 10$ MPa and $\tau xy = -40$ MPa. Using Mohr's circle find (i) Principal stresses, (ii) Principal planes. Also determine the normal and shear stress components on planes making 40° and 60° respectively with the x plane. **10**

4. A simply supported beam ABC with supports at A and B, 6 metres apart and with an overhang BC 2 metres long carries a uniformly distributed load of 15 kN per meter over the whole length shown in fig. Draw S.F. and B.M. diagrams. **10**



5. A timber beam 150 mm wide and 300 mm deep is simply supported over a span of 4 m. Find the maximum uniformly distributed load that the beam can carry, if the stress is not to exceed 8 N/mm^2. **10**

6. A beam of rectangular section of 80 mm by 120 mm carries a uniformly distributed load of 40 kN/m over a span of 2 m an axial compressive force of 10 kN. **10**

   Calculate

   (a) Maximum fibre stress

   (b) Fibre stress at a point 0.50 m from the left end of the beam and 40 mm below the neutral axis.

7. A beam of span 6 m and of uniform flexural rigidity EI = 40000 kNm^2 is subjected clockwise couple of 300 kNm at a distance of 4 m from the left end. Find the deflection at the point of application of the couple. Find the maximum deflection also. **10**

8. Calculate the maximum torque that can be safely transmitted by a shaft of 400 mm diameter, if **10**
   (a) The maximum allowable shear stress is 40 N/mm^2, and
   (b) The maximum allowable angle of twist is 2° in a length of 10 m.
   Take G = 80 kN/mm^2.

9. A thin cylindrical vessel of 2 m diameter and 4 m length contains a particular gas at a pressure of 1.65 N/mm^2. If the permissible tensile stress of the material of the shell is 150 N/mm^2, find the maximum thickness required. **10**

10. A leaf spring having a span of 1.40 m is made of leaves of width and thickness of 100 mm and 12 mm respectively. The maximum bending stress is 150 N/mm^2 and the spring must absorb 125000 N-mm of energy when straightened. Calculate the number of leaves and initial curvature. **10**
    Take E = 200 GPa.