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BME-017

BACHELOR OF TECHNOLOGY IN MECHANICAL ENGINEERING (COMPUTER INTEGRATED MANUFACTURING) BTCLEVI/BTMEVI/BTECVI/BTELVI/BTCSVI

Term-End Examination
June, 2013

BME-017 : STRENGTH OF MATERIALS

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt **any seven** questions only. **All** question carry **equal** marks. Assume suitable missing data, if any.*

1. A steel bar is placed between two copper bars each having the same area and length as the steel bar at 15°C. At this stage they are rigidly connected together at both the ends. When the temperature is raised to 315°C, the length of bars increased by 1.5 mm. Determine the original length and final stresses in the bars. Take $E_s = 2.1 \times 10^5$ N/mm^2, $E_c = 1 \times 10^5$ N/mm^2 $\alpha_s = 0.000012$ per °C and $\alpha_c = 0.0000175$ per °C. **10**

2. A bar ABCD, 950 mm long is made up of three parts AB, BC and CD of lengths 250 mm, 450 mm and 250 mm respectively. AB and CD are cylindrical having diameters 25 mm and 15 mm respectively. The rod BC has square cross-section 30 mm × 30 mm. The rod is subjected to pull of 26000 N. Find **10**

(a) the stresses in three parts of the rod.

(b) the extension of the rod.

Take $E = 2 \times 10^5$ N/mm^2

3. A steel specimen 150 mm^2 in cross-section stretches by 0.5 mm over a 50 mm gauge length under an axial load of 30 kN. Calculate the strain energy stored in the specimen at this stage. If the load at the elastic limit for the specimen is 50 kN. Determine the elongation at elastic limit and the proof resilience. **10**

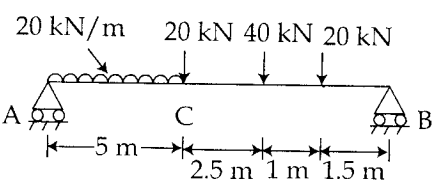
4. A rectangular block of material is subjected to an tensile stresses of 100 N/mm^2 on one plane and a tensile of 50 N/mm^2 on a plane at right angles, together with shear stresses of 60 N/mm^2 on the same planes. Determine : **10**

(a) the direction of principle planes

(b) the magnitude of principle stresses

(c) the magnitude of the greatest shear stresses.

5. Draw the shear force and bending moment diagram for the beam shown in figure below. **10**



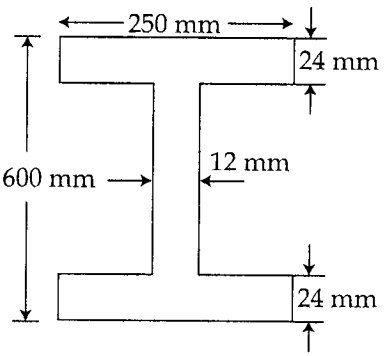
6. A rolled steel joist of I - section has the following dimensions : 10

Flange : 250 mm wide and 24 mm thick

Web : 12 mm thick

Overall depth : 600 mm

If this beam carries a uniformly distributed load of 50 kN/meter run on a span of 8 m. Calculate the maximum stress produced due to bending.



7. A solid circular shaft transmits 75 kW at 200 rpm. Calculate the shaft diameter if the twist in the shaft is not exceed 1° in 2 meters of shaft and the shearing stress is limited to 50 N/mm^2 10

Take $C = 1 \times 10^5$ N/mm^2

8. Determine the thickness of metal necessary for a steel cylindrical shell of internal diameter 150 mm to width-stand an internal pressure of 50 N/mm^2. 10

The maximum hoop stress in the section is not to exceed 150 N/mm^2 .

9. A cast iron beam 40 mm wide and 80 mm deep is simply supported on a span of 1.2 m. The beam carries a point load of 15 kN at the centre. Determine the deflection at the centre. Take E = 108000 $\frac{N}{mm^2}$. **10**

10. A closed coiled helical spring is to have a stiffness of 1N/mm of compression under a maximum load of 45 N and a maximum shearing stress of 126 N/mm^2. The solid length of the spring (when the coils are touching) is to be 45 mm. Determine the diameter of the wire, the mean diameter of the coils and the number of coils required. Modulus of rigidity C = 4.2×10^4 N/mm^2. **10**