No. of Printed Pages : 4

**BME-017**

# B.Tech. MECHANICAL ENGINEERING (COMPUTER INTEGRATED MANUFACTURING)

**BTCLEVI / BTMEVI / BTELVI / BTCSVI / BTECVI**

**Term-End Examination**

00504

**June, 2017**

## 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 (or shortening) of the non-uniform bars (with loads) shown in Figure 1 and Figure 2. *10*

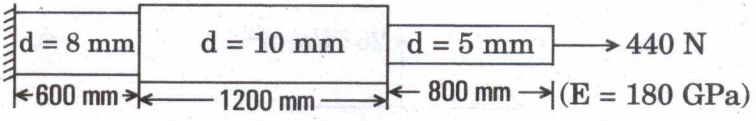


*Figure 1*

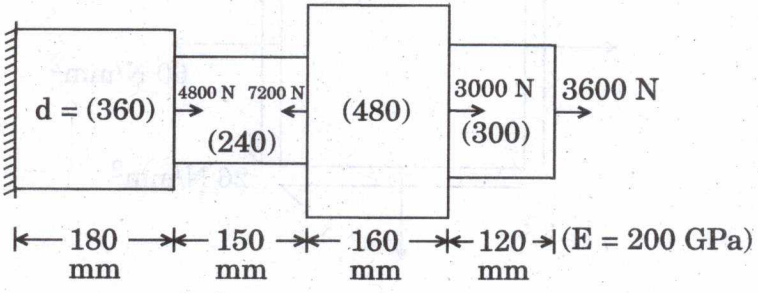


*Figure 2*

2.

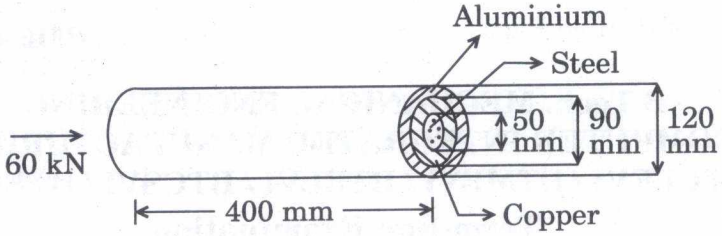


*Figure 3*

The compound bar shown in Figure 3 is placed between two rigid supports with a small gap of 0·1 mm and its temperature is raised by 24°C. Calculate the thermal stress in Aluminium, Copper and Steel if $\alpha_a = 23 \times 10^{-6}$ m/m/°C, $\alpha_c = 18 \times 10^{-6}$ m/m/°C and $\alpha_s = 12 \times 10^{-6}$ m/m/°C. *10*

3. Evaluate the principal stresses and principal planes for the state of stress shown in Figure 4 below. *10*

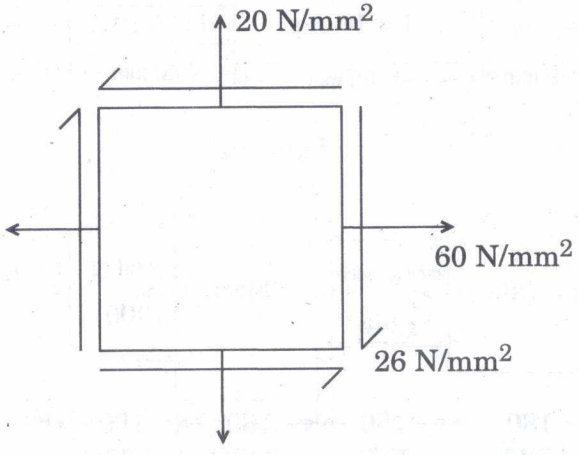


*Figure 4*

4. A mild steel bolt is to be designed to simultaneously carry an axial tensile force of 17 kN along with a shear force of 12 kN. Taking $\sigma_y$ = 260 MPa and Poisson's ratio $\nu$ = 0·32, find the required diameter of the bolt according to (a) Principal Stress Theory, (b) Strain Energy Theory, and (c) Distortion Energy Theory. Take the required factor of safety = 2·0. *10*

5. A cantilever beam of length 8 m is subjected to point loads of 10 kN, 15 kN, 25 kN and 20 kN at distances of 2 m, 4 m, 6 m and 8 m respectively from the fixed end as shown in Figure 5. Draw the shear force and bending moment diagrams. *10*

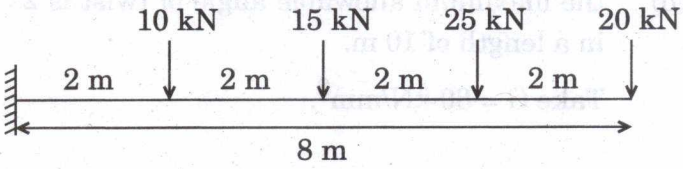


*Figure 5*

6. Derive the expression for shear stress distribution in a circular section under pure torsion. What is the relation between an average and a maximum shear stress ? *10*

7. Find the slope and deflection at the free end of a cantilever beam as shown in Figure 6 below. Take EI = $200 \times 10^6$ $Nm^2$. *10*

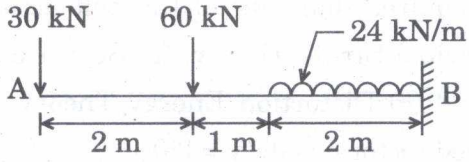


*Figure 6*

8. Calculate the maximum torque that can be safely transmitted by a shaft of 400 mm diameter if

   (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 $kN/mm^2$. *10*

9. A cylindrical shell, 0·8 m in diameter and 3 m long, has a 10 mm wall thickness. If the shell is subjected to an internal pressure of 2·5 $N/mm^2$, determine the (a) change in diameter, (b) change in length, and (c) change in volume. Take E = 200 GPa and Poisson's ratio = 0·25. *10*