No. of Printed Pages : 5

BME-017

01687

BACHELOR OF TECHNOLOGY IN MECHANICAL ENGINEERING (COMPUTER INTEGRATED MANUFACTURING)

Term-End Examination

June, 2010

BME-017 : STRENGTH OF MATERIALS

Time : 3 hours *Maximum Marks : 70*

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

1. A tensile test was conducted on a mild steel bar. The following data was obtained from the test : **10**

(a) Diameter of steel bar = 3 cm

(b) Gauge length of bar = 20 cm

(c) Load at elastic limit = 250 kN

(d) Extension at a load of 150 kN = 0.21 mm

(e) Maximum load = 380 kN

(f) Total extension = 60 mm

(g) Diameter of rod at the failure = 2.25 cm

Determine :

(i) Young's Modulus

(ii) The stress at elastic limit

(iii) Percentage elongation

(iv) Percentage decrease in area

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 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, $\alpha = 1.7 \times 10^{-5}/°C$ and $E = 1.3 \times 10^{11} N/m^2$. **10**

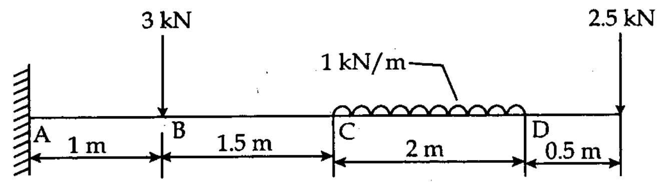
3. A rectangular block of material is subjected to a tensile stress of 110 N/mm^2 on one plane and a tensile stress of 47 N/mm^2 on the plane at right angles to the former. Each of the above stresses is accompanied by a shear stress of 63 N/mm^2 and that associated with the former tensile stress tends to rotate the block anticlockwise. **10**

Find :

(a) the direction and magnitude of each of the principal stresses

(b) magnitude of the greatest shear stress

4. Draw shear force and Bending moment diagrams for the cantilever shown in figure below : **10**



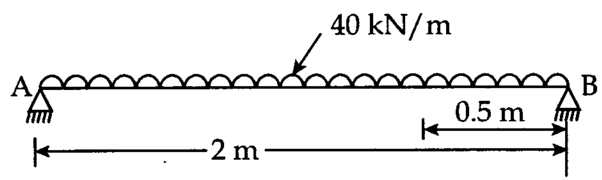
5. A timber beam of rectangular section is simply supported over a span of 5 m. It carries a uniformly distributed load of 15 kN/m over the entire span. Find the width and depth of the beam section if the bending stress is limited to 800/mm^2. The depth to width ratio may be taken as 1.5. **10**

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

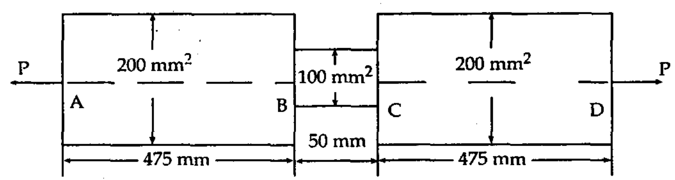
   (a) maximum fibre stress

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

   The beam is shown in figure below :



7. The maximum stress produced by a pull in a bar of length 1 m is 150 N/mm^2. The area of cross sections and length are shown in figure below. Calculate the strain energy stored in the bar if $E = 2 \times 10^5\ N/mm^2$. **10**



8. A beam of span 4 m is subjected to a point load of 20 kN at 1 m from the left support and a UDL of 10 kN/m over a length of 2m from the right support. **10**

Determine :

(a) slope at the ends

(b) slope at the centre

(c) Deflection under the load

(d) Deflection at the centre

(e) Maximum deflection

Take $EI = 20 \times 10^6\ N - m^2$.

9. A hollow and a solid shaft of same material have the same weight while the inner diameter of the hollow shaft is half its outer diameter. What will be the torque carried by the hollow shaft if the solid shaft can carry a torque T for same maximum shearing stress in both the shafts. **10**

10. 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