BACHELOR OF TECHNOLOGY IN MECHANICAL ENGINEERING (COMPUTER INTEGRATED MANUFACTURING)

Term-End Examination

June, 2012

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 straight bar of steel rectangular in section is 10 3 m long and is of uniform thickness 15 mm. The width of the rod varies uniformaly from 100 mm at one end to 40 mm at the other end. If the rod is subjected to an axial tensile load of 30 kN, find the extension of the rod.

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

2. A steel rod 20 mm diameter and 6 metre long is 10 connected to two grips one at each end at a temp. of 120°C. Find the pull exerted when the temperature falls to 40° C.

   (a)   If the ends do not yield

   (b)   If the ends yields by 1.10 mm.

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

   $\alpha = 1.2 \times 10^{-5}$per°C

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

20 N/mm^2

60 N/mm^2

26 N/mm^2
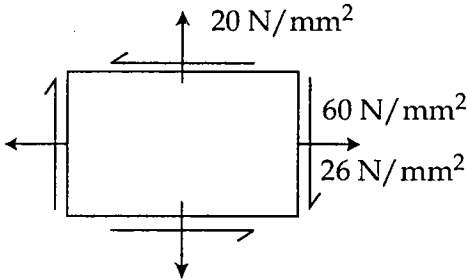
4. A prismatic bar of circular section with 80 mm diameter is subjected to bending moment of 5 kN. m and a torque of 7 kNm. Analyses the state of stress at the critical section. **10**

5. A 12 m span simply supported beam is carrying a uniformly distributed load of 2 kN/m over a length of 6 m from the left end and point loads 6 kN, 3 kN and 4 kN at distances of 7 m, 8 m and 9 m, respectively. Draw SF diagram and BM diagram for the beam and find the maximum bending moment. **10**

6. A rectangular beam of width 200 mm and depth 300 mm is simply supported over a span of 5 m. Find the load that the beam can carry per meter length, if the allowable bending stress in the beam is 100 N/mm^2. **10**

7. Find the strain energy stored due to bending of a **10** steel prismatic bar of cross-section 100 mm × 150 mm deep and 2m long acting as a cantilever supporting a load of 20 kN at the free end. Take $E = 200 \text{ kN/mm}^2$.

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

Determine :

(a) Slope at the ends

(b) Slop at centre

(c) Maximum deflection.

9. A solid shift of 200 mm diameter has the same **10** cross sectional area as that of the hollow shaft of the same material with inside diameter 150 mm. Find the ratio of power transmitted by the two shafts at the same speed.

10. Find the mean radius of an open coiled spring of **10** helix angle of 38°, to give a vertical displacement of 20 mm and an angular rotation of 0.02 radian at free end under an axial load of 30 N. The material available is 6 mm diameter steel bar.