

End Semester Examinations - 2015-16 Even Semester - May 2016

14CE2002 Mechanics of Solids

Set A

Time : 3 hrs
Total Marks: 100

1. (a) A compound tube consists of a steel tube 140 mm internal diameter and 160 mm external diameter and an outer brass tube 160 mm internal diameter and 180 mm external diameter. The two tubes are of same length. The compound tube carries an axial load of 900 kN. Find the stresses carried by each tube. (15 marks)
- (b) A rod is 2 m long at a temperature of 10°C . Find the expansion of the rod, when the temperature is raised to 80°C . Take Young's modulus as $1 \times 10^5 \text{ MN/m}^2$ and coefficient of linear expansion as 0.000012 per degree centigrade. (5 marks)

OR

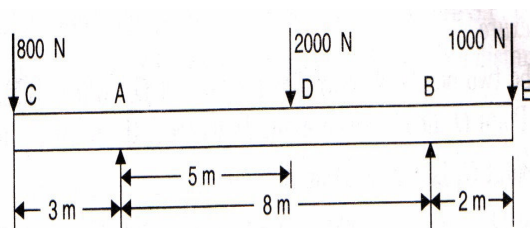
2. (a) The tensile stresses at a point across two mutually perpendicular planes are 120 N/mm^2 and 60 N/mm^2 . Determine the normal, tangential and resultant stresses on a plane inclined at 30° to the axis of the minor stress. (10 marks)
- (b) At a point in a strained material the principal stresses are 100 N/mm^2 (tensile) and 60 N/mm^2 (compressive). Determine the normal stress, shear stress and resultant stress on a plane inclined at 50° to the axis of major principal stress. (10 marks).
3. At a certain point in a strained material, the intensities of stresses on two planes at right angles to each other are 20 N/mm^2 and 10 N/mm^2 both tensile. They are accompanied by a shear stress of magnitude 10 N/mm^2 . Find graphically the location of principal planes and evaluate the principal stresses. (20 marks)

OR

4. (a) A cantilever of length 2 meter fails when a load of 2 kN is applied at the free end. If the section of the beam is $40 \text{ mm} \times 60 \text{ mm}$, find the stress at the failure. (10 marks)
- (b) A rectangular beam 200 mm deep and 300 mm wide is simply supported over a span of 8 m. What uniformly distributed load per meter the beam may carry, if the bending stresses is not to exceed 120 N/mm^2 . (10 marks)
5. (a) A hollow shaft of external diameter 120 mm transmits 300 kW power at 200 r.p.m. Determine the maximum internal diameter if the maximum stress in the shaft is not to exceed 60 N/mm^2 . (10 marks).
- (b) Find the maximum shear stress induced in a solid circular shaft of diameter 15 mm when the shaft transmits 150 kW power at 180 r.p.m. (10 marks)

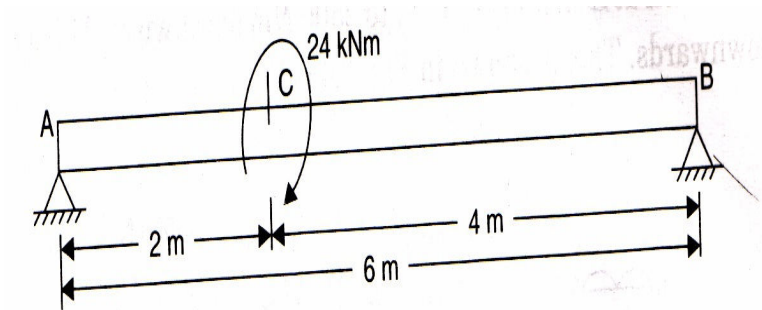
OR

6. Determine the diameter of the solid shaft which will transmit 300 kW at 250 r.p.m. The maximum shear stress should not be exceed 30 N/mm^2 and twist should not be more than 1° in a shaft length of 2 m. Take modulus of rigidity as $1 \times 10^5 \text{ N/mm}^2$. (20 marks)
7. Draw the shear force and bending moment diagrams for the beam which is loaded as shown in the figure. Determine the points of contraflexure within the span AB. (20 marks)

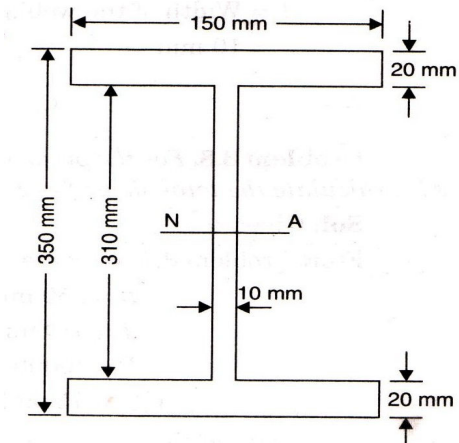


OR

8. A beam 6 m long and simply supported at each end, has a clockwise couple of 24 kNm at point C as shown in the figure. Draw the shear force and bending moment diagrams. (20 marks)



9. An I-section beam $350 \text{ mm} \times 150 \text{ mm}$ has a web thickness of 10 mm and a flange thickness of 20 mm. If the shear force acting on the section is 40 kN, find the maximum shear stress developed in the I-section. (20 marks)



Wishing you All the Best
