No. of Printed Pages : 4

ET-502(A)

B.Tech. Civil (Construction Management) / B.Tech. Civil (Water Resources Engineering)

Term-End Examination

01285

June, 2014

ET-502(A) : STRENGTH OF MATERIALS

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt any* ***five*** *questions. Use of scientific calculator is permitted. Assume any missing data suitably.*

1. (a) A straight bar of steel is 3 m long and has a rectangular section which varies uniformly from 8 cm × 1 cm at one end to 2 cm × 1 cm at the other. What change will occur in its length when subjected to an axial load of 2000 kg. $E = 2{\cdot}1 \times 10^6$ kg/cm^2. 7

(b)

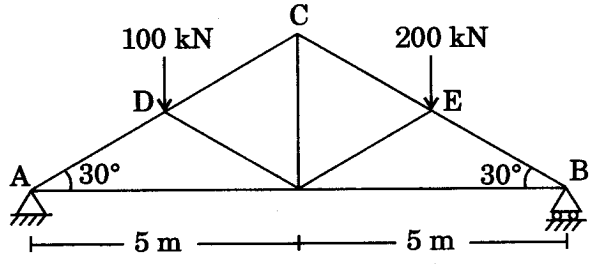

Figure 1

Determine the forces in the members of the truss as shown in Figure 1. Points D and E are the mid span of AC and BC respectively. 7

2. (a) A test beam 3 cm square in section is broken by a load of 120 kg applied at the centre of a span 1 m. Using factor of safety 8, calculate the safe uniformly distributed load for a beam 11 cm wide and 30 cm deep freely supported over a span of 4·5 m. 7

(b) Find the moment of inertia of a T-section (with following details) about a horizontal axis passing through the c.g. of the section 7

Flange 15 cm × 5 cm

Web 15 cm × 5 cm

3. (a) The internal diameter of a hollow shaft is 2/3 of its external diameter. Compare its resistance to torsion with that of a solid shaft of the same weight and material. 7

(b)

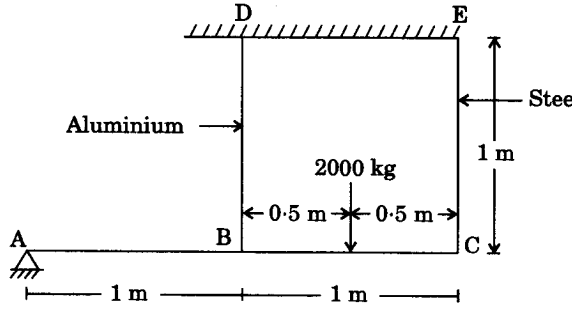

Figure 2

A rigid bar ABC is hinged at A and is supported at two points B and C by two bars BD and EC of aluminium and steel respectively as shown in Figure 2. The bar carries a load of 2000 kg midway between B and C. The cross-sectional areas of bars BD and EC are 3 mm^2 and 2 mm^2 respectively. Find load shared by the two bars. 7

4. (a) What are the assumptions of theory of bending ? Explain with justification. 7

(b) Draw the shear force and bending moment diagrams for the beam shown in Figure 3. 7

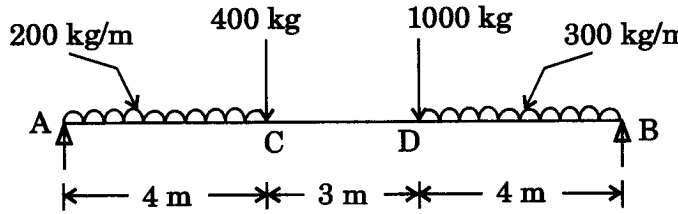

Figure 3

5. (a) A timber beam of depth 16 cm and width 8 cm is reinforced with steel plates of equal width and being 6 mm thick along the longer sides. If the bending stresses in the composite beam are to be limited to 1200 kg/cm^2 in the steel and 100 kg/cm^2 in the timber, estimate the maximum permissible bending moment in the beam. Given $E_{steel} / E_{timber} = 20$. 7

(b) Prove that for a circular section the ratio of maximum shear stress to average shear stress is 4/3. 7

6. (a) What is strain energy ? Determine strain energy in a bar 3·5 m long and 45 mm in diameter when subjected to a tensile load of 100 kN. Take $E = 2 \times 10^5$ N/mm^2. 7

(b) A closely coiled helical spring made of 10 mm diameter steel wire has 15 coils of 100 mm mean diameter. The spring is subjected to an axial load of 100 N. Find maximum shear stress induced. Take $G = 8{\cdot}16 \times 10^4$ N/mm^2. 7

7. (a) A short column of rectangular cross-section 20 cm × 15 cm carries a load of 50 tons at a point 5 cm from the longer side and 9 cm from the shorter side. What are the maximum compressive and tensile stresses in the section ? 7

(b) Calculate the increase in volume of spherical shell 1 m in diameter and 1 cm thick when subjected to an internal pressure of 15 kg/cm^2. $E = 2{\cdot}1 \times 10^6$ kg/cm^2, $\mu = 0{\cdot}3$. 7

8. Write short notes on any ***two*** of the following topics : *2×7=14*

(a) Shear stress for a rectangular section

(b) Stress-strain diagram for mild steel

(c) Principal stresses
