No. of Printed Pages : 4

ET-502(A)

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

Term-End Examination

December, 2013

ET-502(A) : STRENGTH OF MATERIALS

Time : 3 hours *Maximum Marks : 70*

Note : *Answer **any five** questions. All questions carry **equal** marks. Use of scientific calculator is **permitted.***

1. (a) Find the Young's Modulus of a brass rod, of diameter 25mm and of length 250mm, which is subjected to a tensile load of 50kN when the entension of the rod is equal to 0.3mm. 7

(b) A steel rod, of 3cm diameter and 5 m long, is connected to two grips and the rod is maintained at a temperature of 95°C. Determine the stress and pull exerted when the temperature falls to 30°C, if 7

(i) the ends do not yield, and

(ii) the ends yield by 0.12cm. Take $E = 2 \times 10^5$ MN/m^2, and $\alpha = 12 \times 10^{-6}$ /°C.

2. (a) A steel rod , 5m long and 30 mm in diameter, is subjected to an axial tensile load of 50 kN. Determine the change in length, diameter, and volume of the rod. Take $E = 2 \times 10^5$ N/mm^2 and Poisson's ratio $= 0.25$. 7

(b) For a material, Young's Modulus is given as 1.2×10^5 N/mm^2 and Poisson's ratio 0.25. Calculate the Bulk modulus. 7

3. (a) At a point in a strained material, the principal stresses are 100 N/mm^2 tensile and 40 N/mm^2 compressive. Determine the resultant stress in magnitude and direction on a plane inclined at 60° to the axis of the major principal stress. What is the maximum intensity of shear stress in the material at the point ? 7

(b) A steel rod is 2m long and 50mm in diameter. An axial pull of 100kN is suddenly applied to the rod. Calculate the instantaneous stress induced and also the instantaneous elongation produced in the rod. Take E = 200 GN/m^2. 7

4. (a) A bar 12mm diameter gets stretched by 3mm under a steady load of 8000N. What stress would be produced in the same bar by a weight of 800N, which falls vertically through a distance of 8cm on to a rigid collar attached at its end ? The bar is initially unstressed. Take E = 2.0×10^5 N/mm^2. 7

(b) The shear stress in a material at a point is given as 50 N/mm^2. Determine the local strain energy per unit volume stored in the material due to shear stress. Take Modulus of rigidity C = 8×10^4 N/mm^2. 7

5. (a) Draw the stress strain curves of mild steel and medium tensile steel and discuss differences between these curves. 7

(b) Draw the shear force and bending moment diagrams for the beam which is loaded as shown in figure 1. Determine the locations of contraflexure within the span AB. 7

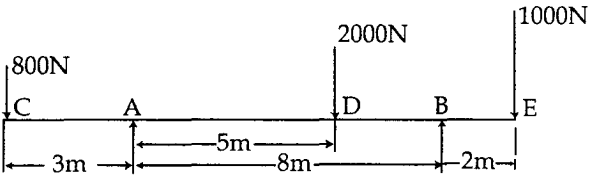

Figure 1

6. (a) Discuss the concept of effective length of columns. Elaborate with the help of neat sketches of columns having various types of support conditions. 7

(b) A circular beam of 100mm diameter is subjected to a shear force of 5kN. Calculate : 7

(i) Average shear stress

(ii) Maximum shear stress, and

(iii) Shear stress at a distance of 40mm from neutral axis.

7. (a) Determine the forces in all the members of a cantilever truss as shown in the figure 2. 7

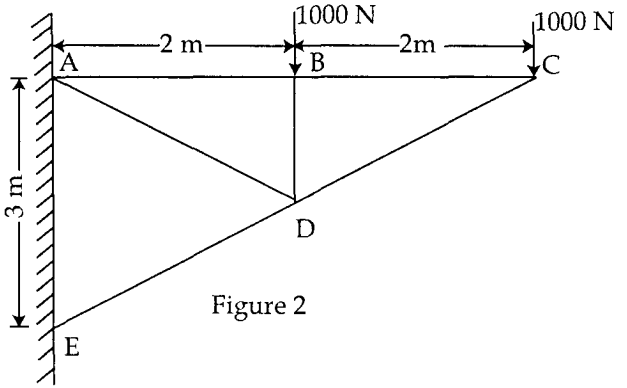

Figure 2

(b) The shearing stress in a solid shaft is not to exceed $40N/mm^2$ when the torque transmitted is 20000 N-m. Determine the minimum diameter of the shaft. 7

8. (a) A hollow shaft is to transmit 300 kW power at 80 rpm. If the shear stress is not to exceed 60 N/mm^2 and the internal diameter is 0.6 times of the external diameter, find the external and internal diameters assuming that the maximum torque is 1.4 times the mean torque. 7

(b) A closed cylindrical vessel made of steel plates 4mm thick with plane ends, carries fluid under a pressure of $3N/mm^2$. The diameter of cylinder is 25cm and length is 75cm, calculate the longitudinal and loop stresses in the cylinder wall. 7