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ET-502(A)

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

Term-End Examination

00280

December, 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 steel rod, circular in section, tapers from 2 cm diameter to 3 cm diameter in a length of 60 cm. Find how much the length will increase under a pull of 3000 kg. $E = 2{\cdot}1 \times 10^6$ kg/cm^2. 7

(b) Prove that

$$E = 3k\,(1 - 2\,\mu)$$

where symbols have their usual meanings. 7

2. (a)

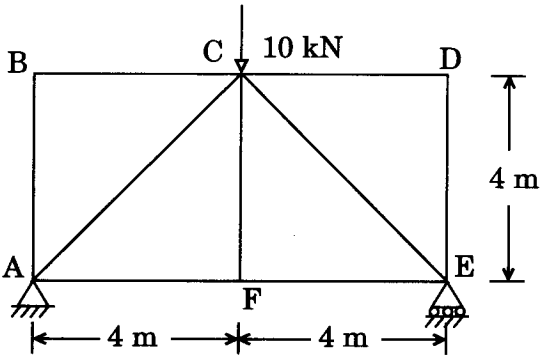

Figure 1

Find the forces in all the members of the pinpointed truss shown in Figure 1. 7

(b) Calculate the width and depth of strongest beam of rectangular section that can be cut out of a cylindrical log of wood whose diameter is 30 cm. 7

3. (a) Compare the weight of a solid shaft with that of a hollow one to transmit a given h.p. at a given speed with a given maximum shear stress; the inside diameter of the hollow shaft is 2/3 of the outside diameter. 7

(b) A weight of 10 kg falls freely through 3 m and is then suddenly checked by the axial reaction of a bar of steel 2 cm in diameter and 9 m long. Find the maximum stress and strain induced in the bar. 7

Take $E = 2{\cdot}1 \times 10^6$ kg/cm^2

4. (a) The stresses on two perpendicular planes through a point are 900 kg/cm^2 (tension), 600 kg/cm^2 (compression) and 450 kg/cm^2 (shear). Find the stress components and resultant stress on a plane at 60° to the plane on which tensile stress acts. 7

(b) Draw shear force and bending moment diagram of the beam, shown in Figure 2. Find the position and magnitude of maximum bending moment. 7

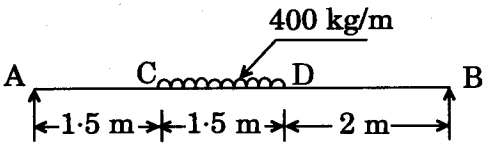

Figure 2

5. (a) A cantilever has a length of 2·5 m. It is of a T section shape with its flange 100 mm × 20 mm and web 200 mm × 12 mm, the flange being in tension. What load per m run can be applied if the maximum tensile stress is 300 kg/cm^2 ? What is the maximum compressive stress ? 7

(b) Prove that for a beam of triangular cross-section the ratio of maximum intensity of shear stress to shear stress at neutral axis is 9 : 8. 7

6. (a) Two 10 cm diameter shafts are connected by means of two flanges with 2 cm diameter bolts equally spaced on a circle of 20 cm diameter. If the maximum shear stress in the shaft due to torque is not to exceed 450 kg/cm^2 and in the bolt is not to exceed 600 kg/cm^2 for the same torque, find the number of bolts required. 7

(b) A cast iron column, 15 cm external and 11 cm internal diameter, carries a vertical load of 20,000 kg. Find maximum allowable eccentricity of this load if maximum tensile stress is not to exceed 300 kg/cm^2. 7

7. (a) A thin cylindrical vessel of diameter 80 cm and thickness 1 cm is filled with water at atmospheric pressure. Find how much the internal pressure will be increased by pumping in 250 cc of water.

$E = 2{\cdot}1 \times 10^6$ kg/cm^2, $\mu = 0{\cdot}286$, $K_{water} = 2{\cdot}2 \times 10^6$ kg/cm^2. 7

(b) Calculate Euler's buckling load of a strut of T section. 7

Flange 10 cm × 1 cm.

Web 8 cm × 1 cm.

The length of strut is 3 m.

$E = 2{\cdot}1 \times 10^6$ kg/cm^2

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

(a) Middle third rule

(b) Shear stress for a circular section

(c) Euler's theory for buckling of column
