Roll No. .....

Total Pages : 3

9138

BT-3/D08

STRENGTH OF MATERIALS–I

Paper : ME-203E

Opt. (i)

Time : Three Hours] [Maximum Marks : 100

Note : There are four units and *eight* questions in total. Attempt *five* questions in all, selecting at least *one* question from each unit. All questions carry equal marks. Assume a suitable value for the missing data, if any.

UNIT–I

1. A steel bolt 2 cm in diameter and 20 cm in diameter passes centrally through a brass tube of 20 cm length, having an outside diameter 4 cm and inside diameter 2.5 cm. The screw has 3 threads per cm and the nut initially just tight on one end of the brass tube. Find the change in stresses in the bolt and the tube due to tightening of the nut by turning through 20°. Take Modulus of the Elasticity for steel = 20×10^6 N / cm^2 and Modulus of the Elasticity for brass = 10×10^6 N / cm^2. 20

2. A body is subjected to pure shearing stresses at a point. The shearing stress on the right hand side is upwards and equal to 1000 N/cm^2. Determine the intensities of normal and shearing stresses with the help of Mohr's stress circle on a plane making an angle of 15° with the *x*-axis. 20

UNIT–II

3. A beam AB, 4 m long carries a uniformly distributed load of 20 kN/m over its entire length. It is supported on a single

support 2 m long as shown in Fig. 1 The beam overhangs equally on two sides of the support. Draw the Shear Force and Bending Moment diagrams. 20

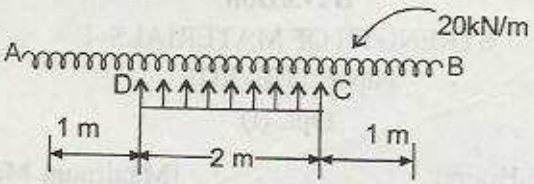

Fig .1

4. A hollow shaft of diameter ratio 0.6 is required to transmit 800 H.P. at 110 rpm, the maximum torque being 1.2 times the mean torque. The shear stress is not to exceed 6300 N/cm^2 and the twist in a length of 3 m is not to exceed 1.4 °. Calculate the minimum external diameter. Take the Modulus of the Rigidity = 8.4×10^6 N/cm^2. 20

UNIT–III

5. A machine component as shown in Fig. 2 is subjected to an inclined force of 30 kN at an angle of 45° with the horizontal. The section of the machine component is rectangular 2 cm wide by 10 cm deep. Determine the section of maximum and minimum bending moments. Also calculate the stresses in the top and bottom layers at the above sections. 20

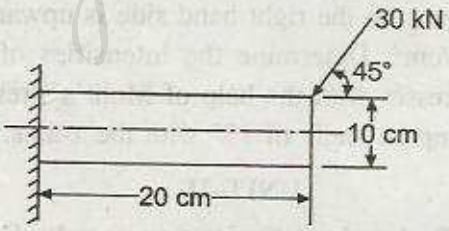

Fig. 2

6. Calculate the safe load for a strut 300 cm long and 4 cm in diameter, when subjected to an axial compressive load, if (a) both ends are pin jointed; (b) both ends are fixed. For what minimum length of strut, does the Euler's formula cease to apply? Take Modulus of the Elasticity = 20×10^6 N/cm^2 and Yield stress = 3.5×10^4 N/cm^2. 20

UNIT–IV

7. A brass tube 100 cm long is simply supported at its ends and carries two concentrated loads of 200 N each at 30 cm and 60 cm from the left end, respectively. Find out the slope and the deflection at the points A, B, C, D and E. For the Section and the material property, take the area moment of inertia of the section $I = 5$ cm^4 and Modulus of the Elasticity = 10×10^6 N/cm^2. Refer Fig. 3. 20

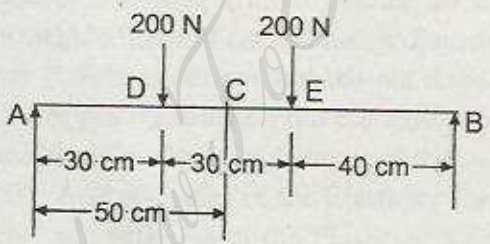

Fig. 3

8. A girder AB of 12 m span is fixed horizontally at the ends. A downward vertical load of 120 kN acts on the girder at a distance of 4 m from the left end A, and an upward vertical force of 80 kN acts at a distance of 6 m from the right end B. Determine the end reactions and fixing couples. 20