S.E. (Mechanical) (Sem-III) (CBSGS) (R-2012)

Paper / Subject Code: 50003 / STRENGTH OF MATERIALS Date - 20/11/19

Time: 3 Hours **Total marks: 80**

N.B.: 1. Question No **1** is **compulsory**
2. Attempt any **Three** questions from the remaining five questions.
3. Assume any **suitable data** if necessary with justification.
4. Figures to the right indicate full marks.

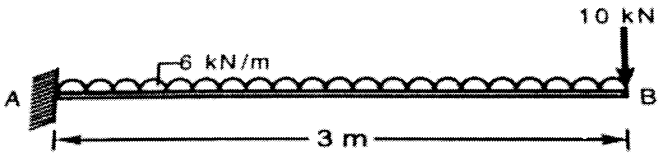
Q1. Attempt any **four** of the following questions. **20**

(a) Draw the shear force and bending moment diagram for a cantilever beam of span L carrying a concentrated load W at free end.
(b) Draw and explain stress-strain diagram for a brittle and ductile material.
(c) Obtain the core of section for circular Section.
(d) What is pure Torsion? State the assumption made in the theory of pure torsion.
(e) Define the following terms:
a) Stress, b) Strain, c) Modulus elasticity, d) Modulus of rigidity, e) Poisson's ratio.

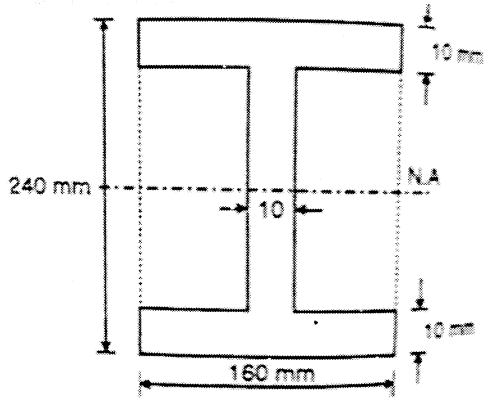
Q2. **(a)** A tube of aluminum 40 mm external diameter and 20 mm internal diameter is fitted on a solid steel rod of 20 mm diameter. The composite bar is loaded in compression by an axial load P. Find the stress in aluminum, when the load is such that the stresses in steel is 70 N/mm^2. Also find the value of P. **10**

Take, E_S=2 x 10^5 N/ mm^2; E_{Al}= 7 X 10^4 N/ mm^2

(b) Draw shear force and bending moment diagram for the beam loaded as shown in the figure. **10**



Q3. **(a)** An I-section is as shown in Figure. Calculate the bending moment it can resist if the bending stress is limited to 100 N/mm^2. **10**



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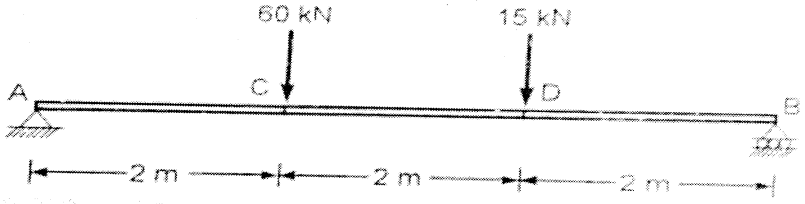
(b) A4 m long cast iron hollow column with both ends firmly fixed supports an axial load of 250 KN. The inside diameter of the column is 0.8 times the external diameter. Determine the section of the column by Rankine's formula. Assume factor of safety to be 5.Take σc=550 N/mm^2 and α=1/1600. **10**

Q4. **(a)** A hollow shaft of diameter ratio 3/5 is to transmit 250 kW at 70 rpm. The maximum torque being 20% greater than mean. The shear stress is not to exceed 60 N/mm2 and twist in a length of 4 m is not to exceed 3 degrees. Calculate the external and internal diameters which would satisfy both the above conditions. Take G = 8 x 104 N/mm2. **10**

(b) A load of 75 KN is carried by a column made of cast iron. The external and internal diameters are 200 mm and 180 mm respectively. If the eccentricity of the load is 35 mm, find: 1.The maximum and minimum stress intensities. **10**

2. Upto what eccentricity there is no tensile stress in the column?

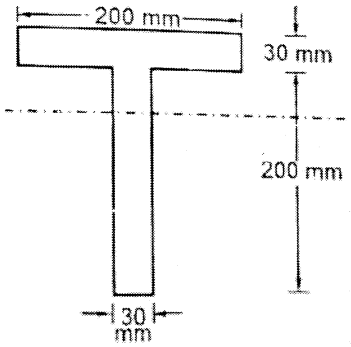
Q5. **(a)** Find the position and magnitude of maximum deflection for the beam loaded as shown in figure. Take E = 200 GPa and moment of inertia of cross section I=4 x 10^7 mm^4. **10**



(b) State the assumptions made in the theory of pure bending and prove: **10**

$$\frac{M}{I} = \frac{\sigma}{y} = \frac{E}{R}$$

6. (a) Figure shows the cross-section of beam which is subjected to is subjected to a shear force of 60 KN. Draw the shear stress distribution across the depth marking values at salient points. **10**



(b) An unknown weight falls though 8 mm on to a collar rigidly connected to the lower end of the vertical bar 4m long and 800mm^{2}in section. If the maximum instantaneous extension is known to be 3 mm, what is the corresponding stress and the value of the unknown weight? Take E = 2 x 10^5 N/mm^2. **10**

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