Code: 9A01302

R09

B.Tech II Year I Semester (R09) Supplementary Examinations June 2016

STRENGTH OF MATERIALS – I

(Civil Engineering)

Time: 3 hours Max. Marks: 70

Answer any FIVE questions

All questions carry equal marks

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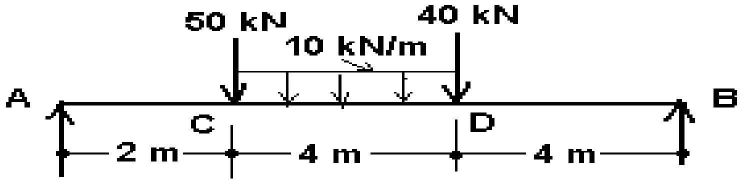
1 A 15 mm diameter steel rod passes centrally through a copper tube 50 mm external diameter and 40 mm internal diameter. The tube is closed at each end by rigid plates of negligible thickness. The nuts are tightened lightly causing negligible stresses in rod and tube. If the temperature of the assembly is raised by 60℃, calculate the stresses developed in copper and steel.
Take: $\alpha_s = 12 \times 10^{-6}/^oC$, $\alpha_c = 17.5 \times 10^{-6}/^oC$, $E_s = 2.0 \times 10^5$ N/mm^2, $E_c = 1.05 \times 10^5$ N/mm^2.

2 (a) Draw SFD & BMD for the beam shown in figure.

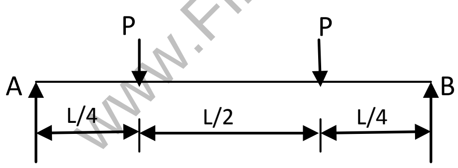


(b) Draw SFD & BMD for a cantilever beam loaded with a UDL of intensity w/unit run for the entire span.

3 (a) Define section modulus? Write the units for section modulus. Derive the section modulus for circular cross section.
(b) A timber beam 150 mm wide and 250 mm deep is simply supported over a span of 5 m. The beam carries a UDL of 3 kN/m over the entire length. Find the maximum bending stress induced. Plot the bending stress distribution at the quarter span cross section of the beam.

4 A beam of 120 mm square section is used with a diagonal in vertical position. If the vertical shear force at a section is 1500 N, find the shear stress at the neutral axis and maximum shear stress and its location in the cross-section.

5 For the beam loaded as shown in fig. determine the deflection at loaded points and at mid span. Also show that the ratio of mid span deflection to deflection at loaded points is 1.375. EI is constant throughout.



6 A horizontal beam ACB, length 2L, is freely supported at the ends A and B with central prop at C. It carries a uniformly distributed load of W per unit length. Show that, if the maximum B.M. In the beam, positive or negative, is to have the least possible value, the proportion of the total load carried by the central prop must be $(2 - \sqrt{2})$ and that it must be set below the level of the outer supports by $(8\sqrt{2} - 11)wl^4/24EI$.

7 A piece of material 15 cm long by 2.5 cm square is in compression under a load of 100 kN. If the modules of elasticity of the material is 105 GPa and Poisson's ratio is 0.25, find the alternation in length if all lateral strain is prevented by the application of uniform lateral external pressure of suitable intensity.

8 The principle stresses at a point in an elastic material are 22 N/mm^2 (tensile), 110N/mm^2 (tensile) and 55 N/mm^2 (compressive). If the elastic limit in simple tension is 220 N/mm^2 and $\mu = 0.3$ then determine whether the failure of material will occur or not according to:
(a) Maximum principal stress theory.
(b) Maximum principle strain theory.
(c) Maximum shear stress theory.
(d) Maximum strain energy theory.
(e) Maximum shear strain energy strain theory.

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