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BT-3/DX

STRENGTH OF MATERIAL – I

Paper : ME-203(E)

Time : Three Hours] [Maximum Marks : 100

Note : 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 tube of 30 mm external diameter and 20 mm internal diameter encloses a copper rod of 15 mm diameter to which it is rigidly joined at each end. If, at a temperature of 10°C there is no longitudinal stress, calculate the stresses in the rod and tube when the temperature is raised to 200°C. Take E_{steel} as 2.1×10^5 N/mm^2 and E_{copper} as 1×10^5 N/mm^2 respectively. The value of co-efficient of linear expansion for steel and copper is given as 11×10^{-6} per°C and 18×10^{-6} per °C respectively. 20

2. The intensity of resultant stress on a plane AB at a point in a material under stress is 800 kN/m^2 and it is inclined at 30° to the normal to that plane. The normal component of stress on another plane BC at right angles to the plane AB is 600 kN/m^2. Determine :
   (a) The resultant stress on plane BC.
   (b) The Principle stresses and their directions.
   (c) The maximum shear stress and their planes. 20

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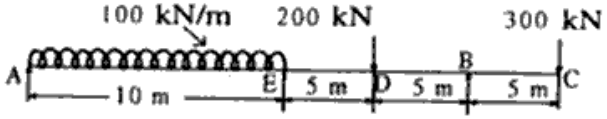
UNIT–II

3. A beam 25 m long is supported at A and B and loaded as shown in fig. below. Sketch the shear force and bending moment diagram and find :
   (a) The position and magnitude of Maximum Bonding moment.
   (b) The position of the point of Contraflexure.



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4. A solid steel shaft of diameter 40 mm is placed inside an aluminium tube having 60 mm external diameter and 50 mm internal diameter. The length of both steel shaft and aluminium tube is 450 mm. The one end of two member is fixed and the other end of two members are connected by a rigid plate. Find the maximum torque to be applied to the plate, if maximum shear stresses in the steel shaft and the aluminium tube are limited to 110 MPa and 65 MPa respectively. Take Modulus of rigidity for steel 80 GPa and Modulus of rigidity for Aluminium as 28 GPa. 20

UNIT–III

5. Two M.S. flats each 50 mm × 10 mm cross–section and a third M.S. flat of cross-section 80 mm × 10 mm are welded to form on I – section having an overall depth of 100 mm and width of 50 mm. The section is used as a horizontal cantilever beam of 1.5 m length to carry a concentrated load at unsupported end. If the allowable bending stresses in tension and compression are not to exceed 100 N/mm^2 and 80 N/mm^2 respectively, find the safe maximum load. Calculate the bending stress of the junction between web and top flange at a section distant 0.5 m from the support. 20

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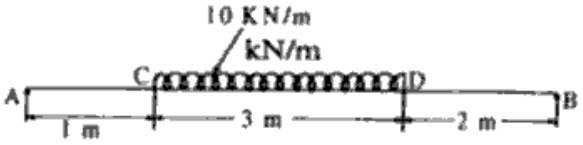
6. Find the Euler crushing load for a hollow cylindrical C.I. column 20 cm external diameter and 25 mm thick if it is 6 m long and is hinged at both ends. Take $E = 1.2 \times 10^6$ N/mm^2. Compare the load with crushing load as given by Rankin's formulae, taking $\sigma_c = 550$ N/mm^2 and $\frac{1}{a} = 1600$; for what length of column would these two formulae give the same crushing load ? 20

UNIT–IV

7. A simply supported beam is loaded with uniformly distributed load of 10 kN/m as shown in figure below. If flexural rigidity EI = 45000 kN/m^2, determine the central deflection and maximum deflection and the location of its occurrence.



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8. A beam of span L has its ends fixed and carries a V.D.L. of W per unit length from left end to mid-span. Calculate the fixing moments and moments and reactions at the supports and draw the bending moment and stear force diagrams. 20

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