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09ENG3.5

Third Semester B.Arch. Degree Examination, Dec.2014/Jan.2015
Structures – III

Time: 3 hrs. Max. Marks: 100

Note: 1. ***Answer any FIVE full questions.***
2. ***Assume and mention missing data if any.***

1 a. From the 1st principles derive the Torsional equation, $\frac{T}{J} = \frac{fs}{R} = \frac{C\theta}{L}$. **(10 Marks)**

b. A solid shaft is to transmit 192 kW at 450 rpm. Taking the allowable shear stress for the shaft material as 70 MPa, find the diameter of solid shaft. What percentage of saving in weight would be obtained if this shaft were to be replaced by a hollow shaft, whose internal diameter is 0.8 times external diameter? The length, material, power transmitted, torsional strength are same in both solid and hollow. **(10 Marks)**

2 a. Proove that hollow shaft is stronger and stiffer than solid shaft of same material, length and weight. **(10 Marks)**

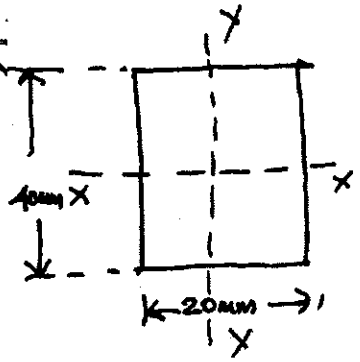
b. A hollow shaft is subjected to a torque of 8100 N-m. The angle of twist in the shaft is to be limited to 1.7° in a length of twenty times outer diameter. Taking inner diameter to outer diameter as 0.7, determine the inner and outer diameter and maximum shear stress induced. Take the modulus of rigidity of shaft material as 80 GPa. **(10 Marks)**

3 a. What are assumptions made in deriving the Euler's buckling load? **(04 Marks)**

b. What are the limitations of Euler's formula? **(06 Marks)**

c. Derive the Euler's (Buckling load) equation for column of length l, with both ends hinged. **(10 Marks)**

4 a. Fig. Q4 (a) shows a cross section whose area's are equal. Determine the buckling load in each case, taking the length of column as 2 mts and both ends are hinged. Also compare the loads taken by column with rectangular section and T section. Take E = 210 GPa. **(11 Marks)**



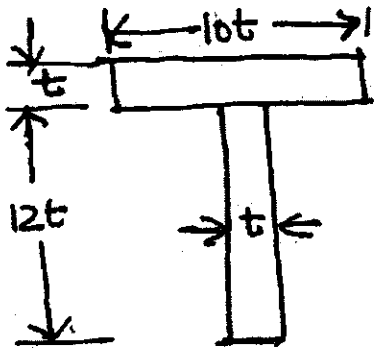


Fig. Q4 (a)

b. A 2.5 mts long hollow circular column with inner diameter to outer diameter ratio of 0.8 is to carry a load of 136 kN. One end of the column is fixed and other end is hinged. Determine the diameters of the column, taking $\sigma_c = 320$ MPa and $a = \frac{1}{7500}$ for the material of the column. Take FOS = 2.5 **(09 Marks)**

7 b. A beam AB is simply supported at A and B 6 mts apart as shown in Fig. Q7 (b). The beam is subjected to a clockwise couple of 300 kNmt at a distance of 4 mts from left and as shown in Fig. Q7 (b). If E = 2.0×10^5 N/mm^2 & I = 2×10^8 mm^4. Determine the deflection at point where couple acts. The maximum deflection and its position. Draw the elastic curve.

(12 Marks)

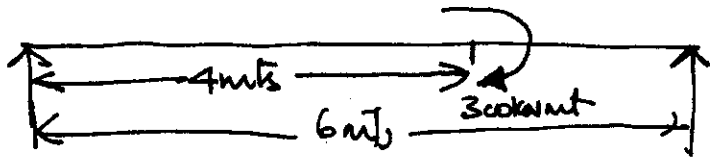


Fig. Q7 (b)

8 a. For a cantilever beam subjected to uniformly distributed load of intensity W kN/mt over the entire span. Determine the maximum slope and maximum deflection using moment area method. **(10 Marks)**

b. Find maximum slope and maximum deflection for the beam shown in Fig. Q8 (b). Find deflection at load points. **(10 Marks)**

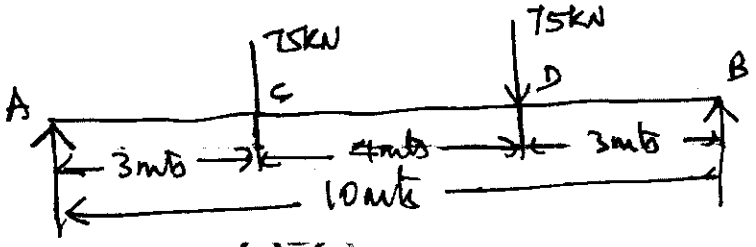


Fig. Q8 (b)

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