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09ENG3.5

Third Semester B.Arch. Degree Examination, June/July 2019
Structures – III

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions.***

1 a. Derive torsional equation with usual notations. **(10 Marks)**

b. Compare the weight of solid shaft with that of hollow one having the same length to transmit a given power at a given speed, if the material used for both the shaft is the same. Take the inside diameter of hollow shaft as 0.6 times the outer diameter. **(10 Marks)**

2 a. What are the assumptions made in the theory of torsion? **(06 Marks)**

b. A shaft is required to transmit 245 kW power at 240 rpm. The maximum torque may be 1.5 times the mean torque. The shear stress in the shaft should not exceed 40 N/mm^2 and the twist 1° per meter length. Determine the diameter required if (i) Shaft is solid (ii) The shaft is hollow with external diameter twice the internal diameter. Take modulus of rigidity = 80 kN/mm^2. **(14 Marks)**

3 a. State the assumption made in Euler's theory. Explain the limitations of Euler's formula. **(08 Marks)**

b. Determine the buckling load for a strut of 'T' section. The flange width being 100mm. Overall depth 80mm and both flange and stem 10mm thick. The strut is 3m long and is hinged at both ends. Take E = 200 kN/mm^2. **(12 Marks)**

4 a. Derive Euler's equation for crippling load of a column whose both ends are hinged. **(10 Marks)**

b. A hollow cast iron column whose outside diameter is 200 mm and has a thickness of 20mm is 4.5m long and is fixed at both ends. Calculate the safe load by Rankine's load. Take $E = 1\times10^5$ N/mm^2. Rankine's constant. a = 1/1600 for both ends pinned case and $f_c = 550$ N/mm^2. **(10 Marks)**

5 a. Derive the equation $M_x = EI\frac{d^2y}{dx^2}$ with usual notations. **(10 Marks)**

b. Find the displacement at free end of the cantilever shown in Fig.Q5(b). Find its numerical value if L = 3m, a = 2m, w_1 = 20 kN, w_2 = 30 kN, $E = 2\times10^5$ N/mm^2, $I = 2\times10^8$ mm^4.

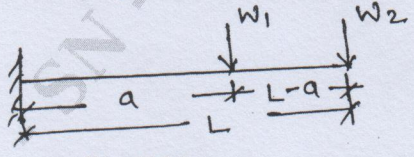

Fig.Q5(b) **(10 Marks)**

6 A simply supported beam of 6m span is subjected to a concentrated load of 18 kN at 4m from left support calculate :

(i) The position and the value of maximum deflection

(ii) Slope at mid-span

(iii) Deflection at the load point

Given E = 200 GPa, $I = 15\times10^6$ mm^4. **(20 Marks)**

7 a. Find the slope and deflection at the free end of cantilever beam of span 'L' when loaded with udl of W kN/m over the entire span. Use double integration method. **(12 Marks)**

b. Find the displacement of free end of cantilever beam shown in Fig.Q7(b). Take $E = 2\times10^5\ N/mm^2$, $I = 180\times10^6\ mm^4$. **(08 Marks)**

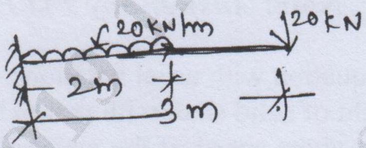

Fig.Q7(b)

8 Write short notes on :

a. Explain effective length in column
b. Prove that a hollow shaft is stiffer than solid shaft
c. Distinguish between long and short column
d. Rankine's formula for crippling load in column **(20 Marks)**

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