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09ARC3.5

# Third Semester B. Arch. Degree Examination, June/July 2018
## Structures – III

Time: 3 hrs. Max. Marks:100

**Note:** ***1. Answer any FIVE full questions.***
***2. Missing data, if any, may be suitably assumed and mentioned.***



1 a. Explain briefly the following :
i) Pure torsion
ii) Polar modulus **(03 Marks)**

b. From the 1st principles drive the torsional equation. **(10 Marks)**

c. A solid shaft rotating at 500rpm transmits 30 KW. Maximum torque is 20% more than mean torque. Material of shaft has the allowable shear stress 65MPa and modulus of rigidity 81GPa Angle of twist in the shaft should not exceed 1° in 1.0 meter length. Determine the diameter of the shaft. **(07 Marks)**

2 a. A solid shaft is to transmit 192 KW at 450 rpm. Taking the allowable shear stress for the shaft material as 70MPa. Find the diameter of the solid shaft. What percentage of saving in weight would be obtained, if this shaft were to be replaced by "HOLLOW SHAFT", whose interval diameter is 0.8 external diameter. The length material and speed are power transmitted are equal in both the cases. **(11 Marks)**

b. During tests on a sample of steel bar 25mm in diameter, it is found that a pull of 50kN produces an extension of 0.095mm on a length of 200mm and a torque of 200 Nmt produces an angular twist of 0.9 degrees on a length of 250mm. Find the Poisson's ratio of the steel. **(09 Marks)**

3 a. What are assumptions made in Euler's theory? **(03 Marks)**

b. Derive an equation for Euler's buckling load of a column. When both ends of column are hinged. **(10 Marks)**

c. Determine the buckling load for a strut of Tee section shown in Fig.Q3(c). The strut is 3.0mt long and is hinged at both ends. Take E = 2.00 GN/mt$^2$. **(07 Marks)**

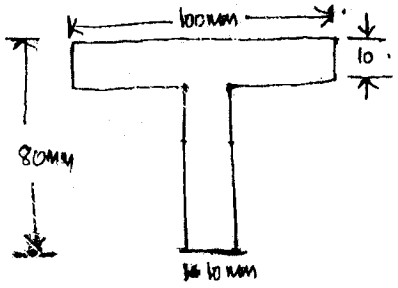


Fig.Q3(c)

4 a. Define slenderness ratio. State the limitations of Euler's formula. **(06 Marks)**

b. A 1.5mt long column has a circular cross section of 5 cms diameter, one of the ends of column is fixed in direction and position and other is free. Taking factor of safety as '3'. Calculate the safe load using :

i) Rankine's formula take yield stress as 560 N/mm$^2$ and $a = \frac{1}{1600}$ for pinned ends.

ii) Euler's formula Young's modulus of CI = $1.2 \times 10^5$ N/mm$^2$. **(14 Marks)**

5 a. For a simply supported beam of span L mts subjected to a udl of ω kN/mt over the entire span, determine the slope at the supports and maximum deflection. **(10 Marks)**

b. For the beam shown in Fig.Q5(b), determine the deflection at C. Take EI = 10,000 kN-m². **(10 Marks)**

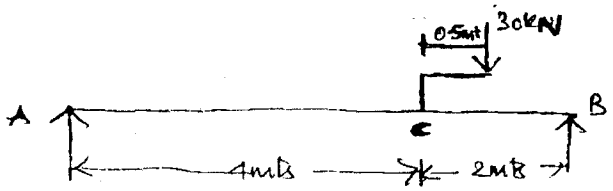


Fig.Q5(b)

6 a. A cantilever beam of span L mts is subjected to udl over the entire length. Determine the slope and deflection. **(06 Marks)**

b. Plot the elastic curve and find maximum slope and deflection (maximum) for cantilever beam shown in Fig.Q6(b). Take EI = $6 \times 10^{13}$ N mm². **(14 Marks)**

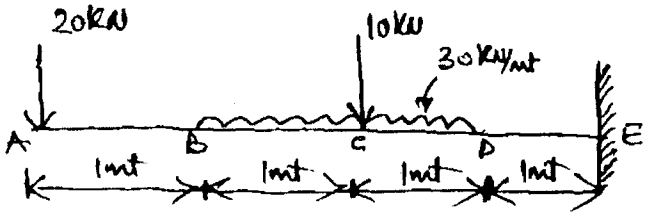


Fig.Q6(b)

7 A simply supported beam is subjected to forces as shown in Fig.Q7. If EI = 336 × 10 N mm². Determine :

i) Slope at the supports
ii) Deflection under the loads
iii) Maximum deflection and its position. **(20 Marks)**

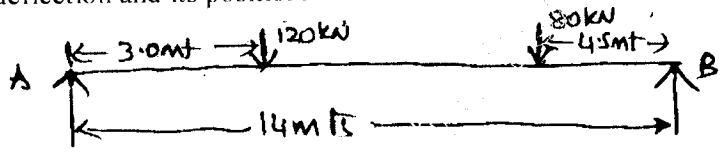


Fig.Q7

8 a. A simply supported beam of span L mts carries a udl of ω kN/mt over its entire span. Using "Moment Area Method" find maximum slope and maximum deflection. **(10 Marks)**

b. Find the maximum slope and maximum deflection for simply supported beam shown in Fig. Q8(b) by "Moment Area Method". **(10 Marks)**
E = 84 GPa ; I = 33.75 × $10^6$ mm⁴.

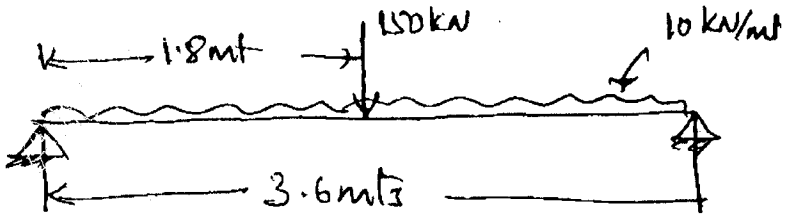


Fig.Q8(b)

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