Ex/BESUS/AM-201A/07

B.Arch. Part-I 2nd Semester Examination, 2007

Strength of Materials

(AM-201A)

Time : 3 hours **Full Marks : 70**

Use separate answerscript for each half.
Answer SIX questions, taking THREE from each half.
The questions are of equal value.

FIRST HALF

1. State the assumptions made in simple theory of bending.
   A circular pipe of external diameter 70 mm and thickness 8 mm is used as a simply supported beam over an effective span of 2.5 m. Find the maximum concentrated load that can be applied at the centre of the span if permissible stress in bending in tube is 150 N/mm^2.

2. A T-section beam of flange width 100 mm, thickness 12 mm and web length 88 mm and thickness 12 mm is subjected to a shear force of 20 kN. Draw shear stress distribution across the depth marking values at salient points.

3. A simply supported beam of 6 m span is subjected to a concentrated load of 18 kN at 4 m from left support.
   Calculate :-
   a) Slope at mid-span
   b) Deflection at the load point
   Take $E = 200$ GPa & $I = 15 \times 10^6$ mm^4.

4. State the assumptions made in the Euler's Column theory.
   Find an expression for crippling load when one end of the column is fixed and other end is free.

5. A column of timber 15 cm wide and 20 cm deep is 6 m long and both ends being fixed. If the Young's modulus for timber is 17.5 kN/mm^2, determine
   i) Crippling load
   ii) Safe load for the column if factor of safety is 3.

SECOND HALF

6. a) Define stress, strain and Poisson's Ratio.

   b) Three pieces of wood having 3.75 cm x 3.75 cm square cross-sections are glued together and to the foundation as shown in Fig.Q.6. If the horizontal force of P = 3 kN, what is the average shearing stress in each of the glued joints.

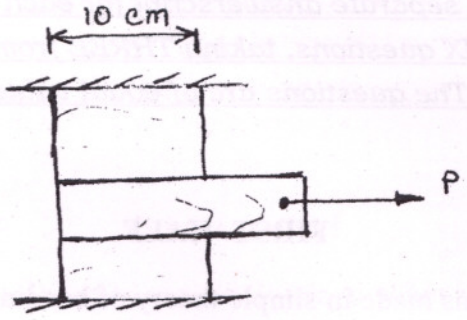


Fig.Q.6

6. A hollow steel cylinder of length $l = 30$ cm, inside diameter $d = 15$ cm, and uniform wall thickness $t = 3$ mm is filled with concrete and compressed between rigid parallel plates by a load P = 5 kN. Calculate the compressive stress in each material and the total shortening of the cylinder if $E_s = 2(10)^6$ kg/cm^2 for steel and $E_c = 2(10)^5$ kg/cm^2 for concrete.
   Assume both materials obey Hooke's law.

8. a) Explain the condition of 'pure shear'.

   b) Establish the relation among three elastic constants, viz, E, μ, G where the symbols stand for their conventional sense.

9. Three tension members having the dimensions shown in Fig.Q.9 each carry the same tensile load P. Compute the amount of strain energy stored in the three cases, assuming that the stress is uniformly distributed over each cross-section.

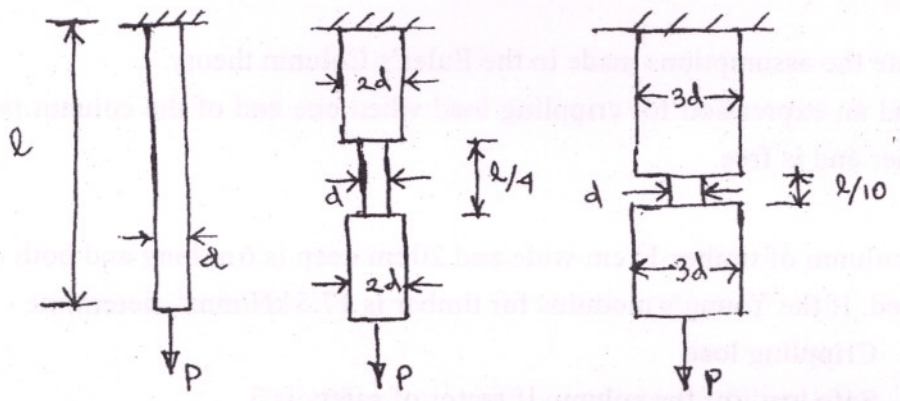
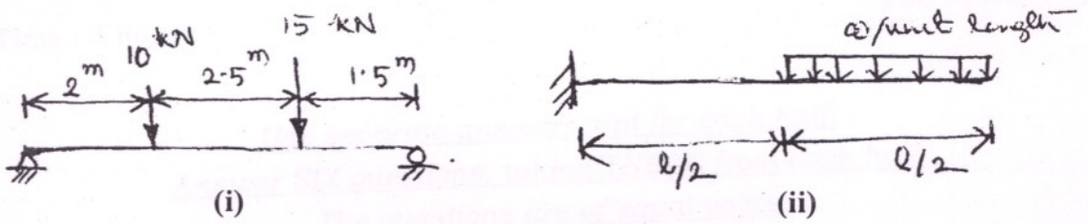


Fig.Q.9

10. Draw the bending moment and shear force diagrams for the beams loaded and supported as shown in Fig.Q.10.



(i) (ii)

Fig.Q.10

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