B. Arch. Part-I 2nd Semester Examination, 2009

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.
Notations are having their usual meanings.

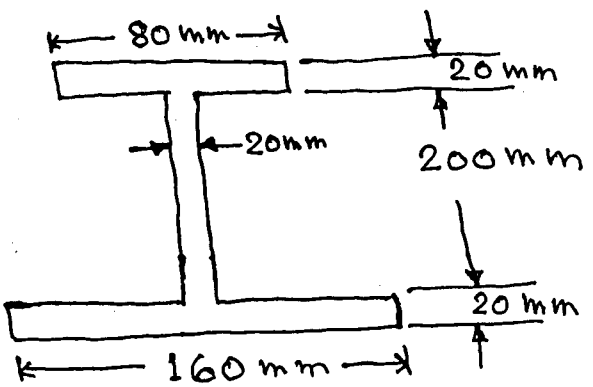
FIRST HALF

1. Draw Shear force and Bending moment diagram for a simply supported beam of length 9 meters and carrying a uniformly distributed load of 10kN/m for a distance of 6 meters from the left end. Also calculate maximum Bending moment on the section.

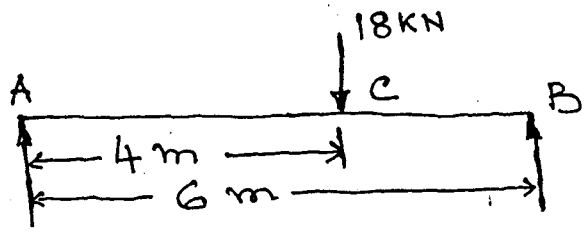
2. a) A timber beam of rectangular section is to support a load of 20 kN uniformly distributed over a span of 3.6 meters when beam is simply supported. If the depth of section is to be twice the breadth and the stress in the timber is not to exceed 7 N/mm^2, find the dimensions of the cross-section.

   b) State the assumptions made in simple theory of bending.

3. The unsymmetrical I-Section shown in figure below is subjected to a shear force of 40 kN. Draw the shear stress distribution diagram across the depth marking values at salient points.



4. A simply supported beam of 6 meters span as shown in figure below is subjected to a concentrated load of 18 kN at 4 meters from left support. Calculate
   i) The position and the value of maximum defection.
   ii) Slope at mid-span.
   iii) Deflection at the load point.
   Take E = 200 GPa & I = 15×10^6 mm^4.



5. State the assumptions made in the theory of pure torsion.
   Compare the weight of solid shaft with that of a hollow one having 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 the hollow shaft as 0.6 times the outer diameter.

SECOND HALF

6. a) Three pieces of wood having 3.75 cm x 3.75 cm square cross-sections are glued togther and to the foundation as shown in Fig.Q.6a. If the horizontal force P = 3,000 kg, what is the average shear stress in each of the glued joints?

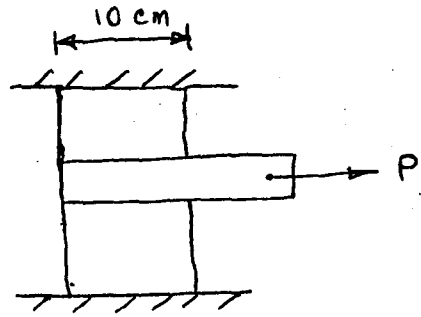


Fig.Q.6a

   b) A prismatic steel bar having cross-sectional area A = 3 cm^2 is subjected to axial loading as shown is Fig.Q.6b. Neglecting localized irregularities in stress distribution near the points of application of the loads, find the net increase δ in the length of the bar. Assume E = 2×10^6 kg /cm^2.

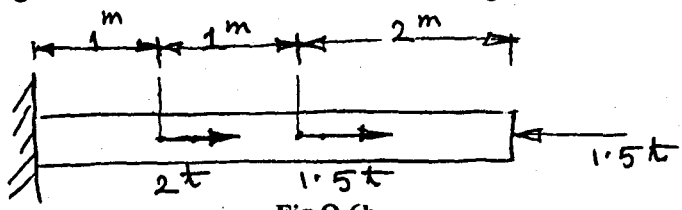


Fig.Q.6b

7. A steel ring is fitted on a wooden wheel of diameter 1 m by raising the temperature of the steel ring through 60°C. Find the original diameter of the steel ring. Also calculate the stress developed in the ring when it cools back to normal temperature. Assume, $E_S = 2.1 \times 10^5$ N/mm^2 and $\alpha_S = 2.1 \times 10^{-6}$/°C.

8. A small weight W is attached to one end of an elastic string and the other end of the string is lied to a fixed support. If the weight W is allowed to fall freely through the full length of the string, what maximum tensile stress σ will be produced in the string ? The string has a cross-sectional area A, length l, modulus of elasticity E and can be considered weightless.

9. Starting from fundamentals, show that

$$G = \frac{E}{2(1+\mu)}.$$

10. In a civil engineering site, a solid steel post of 3m length and 250 mm x 450 mm cross-section is fixed at its bottom in the ground and its top is open. If a heavy wt. of 100 kg suddenly fall on the top of the post from a clear height of 500 mm due to breakage of chain from the crane, find out the max$^{m.}$ instantaneous compression of the post. Assume $E = 2 \times 10^5$ N/mm^2.