Exam Date & Time: 21-Nov-2019 (09:00 AM - 12:00 PM)

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

THIRD SEMESTER B.TECH END SEMESTER EXAMINATIONS, NOV 2019

STRENGTH OF MATERIALS [AAE 2173]

Marks: 50 **Duration: 180 mins.**

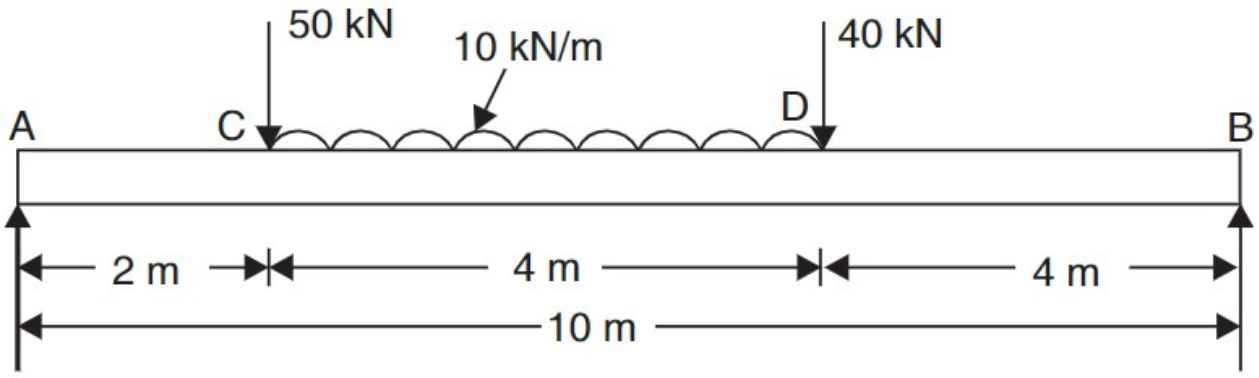
A

Answer all the questions.

Instructions to Candidates: Answer ALL questions Missing data may be suitably assumed

1) A simply supported beam of length 10m, carries the uniformly distributed load and point load a shown in the figure 1. Draw the shear force and bending moment for the beam also find the maximum bending moment

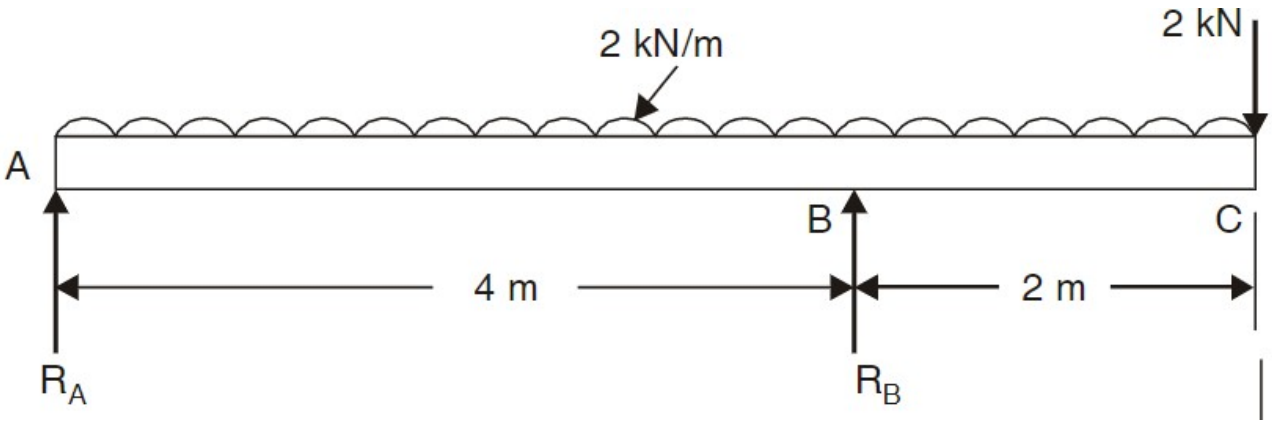
A)



(4)

Figure 1

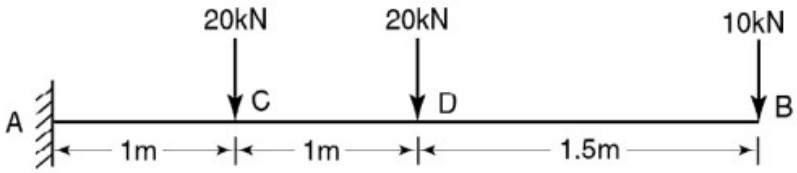
B) Draw shear force and bending moment diagrams for the overhanging beam carrying uniformly distributed load of 2kN/m over the entire length and point load of 2kN as shown in the figure 2. Locate the point of contraflexture.



(4)

Figure 2

C) Draw the shear force and bending moment diagram for the beam shown in figure 3

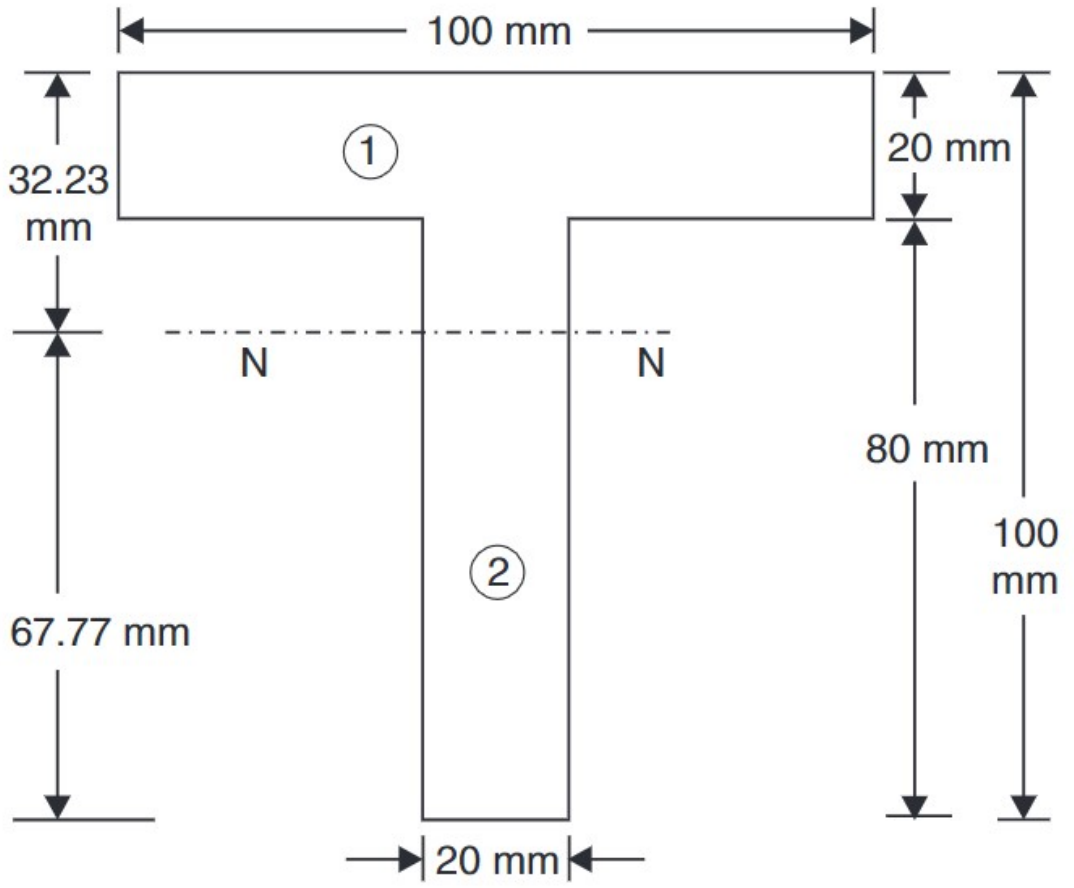


(2)

Figure 3

2) A T-section cast iron beam as shown in the figure 4. The beam is simply supported on a span of 8m. The beam carries a uniformly distributed load of 1.5kN/m length on the entire span. Determine the maximum tensile and compressive stresses.

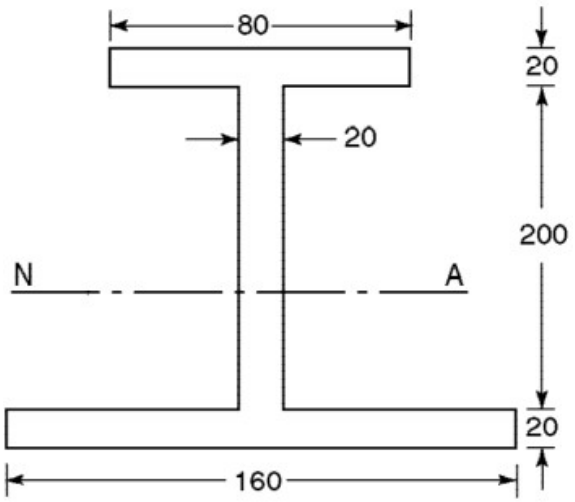
A)



(5)

Figure 4

B) The unsymmetrical I-section shown in the figure 5, is subjected to shear force of 40kN. Draw the shear stress variation diagram across the depth



(5)

Figure 5

3) Using Macaulay's Method, determine the deflections at points C, D and E in the beam shown in Figure (5)

6. Take $E = 200\,k\frac{N}{mm^2}$ *and* $I = 6 \times 10^6\ mm^4$.

A)

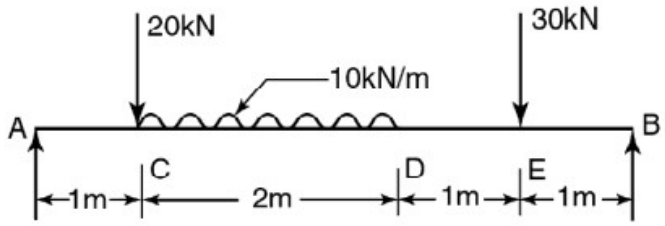


Figure 6

B) Determine the deflection under the concentrated load and the maximum deflection in the beam shown in the figure 7 using Moment Area method. (3)

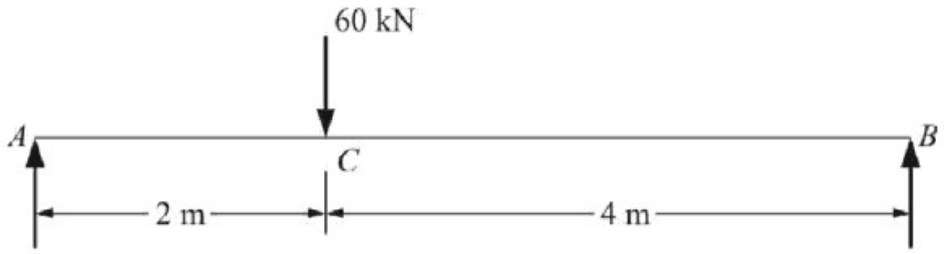


Figure 7

C) Find the deflection at the free end in a cantilever beam shown in Figure 8 using double integration method (2)

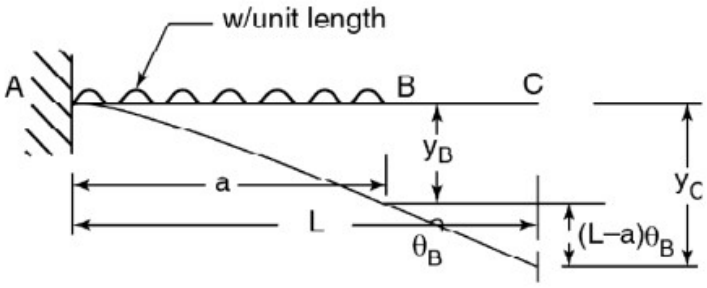


Figure 8

4) A shaft ABC of 500mm length and 40mm external diameter is bored, for a part of its length AB, to a 20mm diameter and for the remaining length BC to a 30mm diameter bore. If the shear stress is not to exceed 80 N/mm^2, find the maximum power, the shaft can transmit at the speed of 200 rpm. If the angle

A) of twist in the shaft of length 20mm diameter bore is equal to that in 30mm diameter bore, find the shaft that has been bored to 20mm and 30mm diameter. (4)

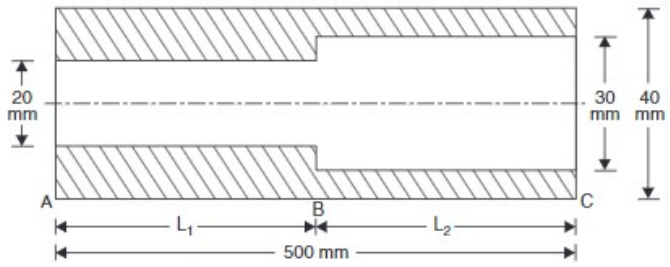


Figure 9

B) A solid shaft transmit 250kW at 100rpm. If the shear stress is not to exceed 75 N/mm^2, what should be the diameter of the shaft? If this shaft is to be replaced by hollow one whose internal diameter =0.6 times the outer diameter, determine the size and the percentage saving in weight, the maximum shearing stress being the same. (4)

C) Determine the diameter of the solid steel shaft which will transmit 90kW at 160rpm. Also determine the length of the shaft if the twist must not be 1^0 over the entire length. The maximum shear stress is limited to 60n/mm^2. Take the modulus of rigidity =$8 \times 10^4\ N/mm^2$. (2)

5) Derive the equation for hoop stress in the thin cylinder. (2)

A)

B) A thick cylindrical pipe with outside diameter 300 mm and internal diameter 200 mm is subjected to an internal fluid pressure of 14 N/mm^2. Determine the maximum hoop stress developed in the cross-section. Sketch the variation of hoop stress across the thickness of the pipe. What is the percentage of error if the maximum hoop stress is found from the equation for thin pipes? (4)

C) Calculate the change in diameter, change in length and change in volume of the thin cylindrical shell 100cm diameter, 1 cm thick and 5m long when subjected to internal pressure of 3N/mm^2. (4)

Take $E = 2 \times 10^5\ and\ Poisson's\ ratio, \mu = 0.3$

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