

Dec.-23-0394

CE-401 (Structural Analysis-I)

B.Tech. 4th (CBCS)

Time : 3 Hours

Max. Marks : 60

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt five question in all, selecting one question each from section A, B, C and D. Section E is compulsory.

SECTION - A

1. Find axial force in each member of the pin jointed truss shown in Figure 1. (10)

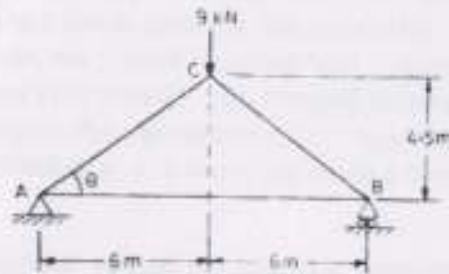


Figure 1

2. Determine the rotation and deflection at the free end of the cantilever beam ( $L=10$  m) subjected to uniformly distributed load ( $w=5$  kN/m) over an entire span as shown in the figure. (10)

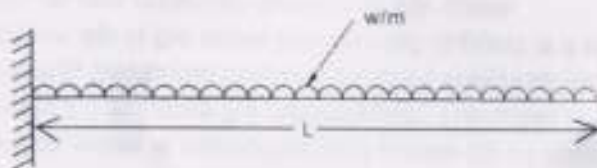


Figure 2

SECTION - B

3. Determine the deflection under 60 kN load in the beam shown in Figure 3 using strain energy method. (10)

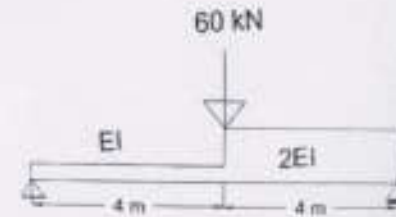


Figure 3

4. Find deflection at mid span of the cantilever beam in Figure 4 using virtual work method. Assume flexural rigidity constant throughout the length. (10)

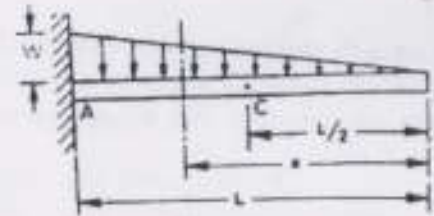


Figure 4

SECTION - C

5. A three-hinged parabolic arch has a span of 30 m and a central rise of 6 m. Five wheel loads of 4, 5, 5, 3 and 3 kN spaced 3, 2, 3 and 2 m in order cross the arch from left to right with 4 kN load leading. When the leading load is at 20 m from the left support, calculate the horizontal thrust in the arch. Also, calculate the bending moment at a section under the tail load. (10)

6. A suspension cable is supported at 2 points 25 m apart. The left support is 2.5 m above the right support. The cable is loaded with a uniformly distributed load of 10 kN/m throughout the span. The maximum dip in the cable from the left support is 4 m. Find the maximum and minimum tension in the cable. (10)

#### SECTION - D

7. Two-point loads of 4 kN and 6 kN spaced at 6 meters apart cross a girder of 16-meter span, the 4 kN load leading from left to right. Construct the maximum shear force and bending moment diagrams, stating the absolute maximum values. (10)
8. Four wheel loads of 6, 4, 8 and 5 kN cross a girder of 20 meter span, from left to right followed by U.D.L. of 4 kN/m and 4 meter long with 6 kN load leading. The spacing between the loads in the same order are 3 meter, 2 meter and 2 meter. The head of the U.D.L. is at 2 meter from the last 5 kN load. Using influence lines, calculate the S.F. and B.M. a section 8 m from the left support when the 4 kN load is at centre of the span. (10)

#### SECTION - E (Compulsory)

9. Explain following:
- Write merits and demerits of conjugate beam method over moment area method.
  - Write a short note on virtual work method.
  - What do you understand by the axial loading, bending loading and transverse loading, explain with neat sketch on any beam.
  - Discuss principal of superposition.

- If a U.D.L of intensity  $w$  kN/m and length ' $a$ ' ( $a < L$ ) moving from left to right over a simply supported beam of length ' $L$ ', what will be the condition of maximum bending moment?
- What is general cable theorem?
- Write down the criteria for the stability of a structure.
- What is the expression for horizontal thrust for a three hinged semi-circular arch (Span  $L$ ) subjected to a point load ' $W$ ' at crown?
- What is the advantage of moment area method over double integration method?
- Draw influence line diagram for support reactions at distance ' $x$ ' from left end of a simply supported beam of length ' $L$ ' when a unit load moves from left end to right end. (10×2=20)