May-25-0331

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 questions in all, selecting one question each from Section A, B, C & D. Section E is compulsory.

SECTION - A

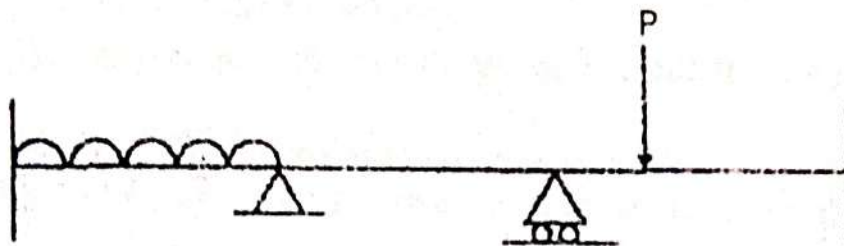1. Find static and kinematic indeterminacy for the frame shown in Figure 1.   (10)

Figure 1

2. Determine the slope at the free end of the beam and free deflection at the free end of the beam shown in Figure 2. EI = constant.   (10)
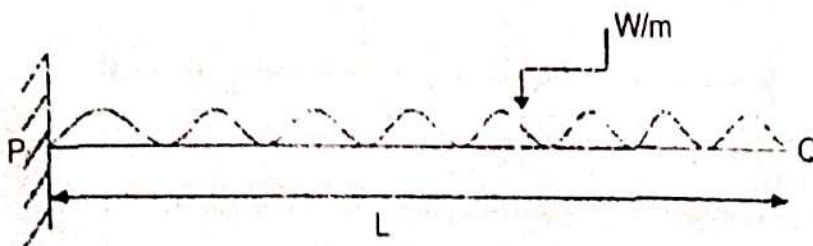

Figure 2

SECTION - B

3. Prove Maxwell's Reciprocal Theorem for a linear elastic structure. Clearly state the assumptions involved and provide a detailed step-by-step proof of the theorem, using appropriate mathematical formulations.   (10)

4. A uniform cantilever beam is shown in Figure 3, in which 10 kN is applied at B as indicated. Determine the magnitude and direction of the deflection and slope at B, using unit load method. (10)
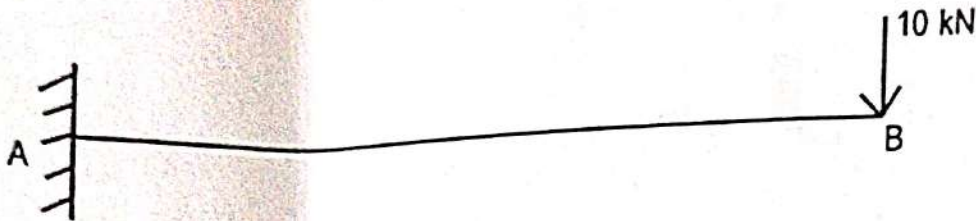
10 kN

Figure 3

A

B

SECTION - C

5. A three-hinged arch is subjected to a concentrated load and uniformly distributed load, as shown in Figure 4. Determine the support reactions of the arch. (10)

4 kN/m

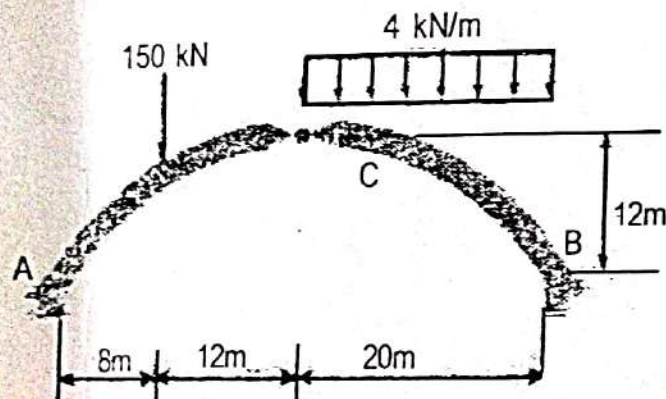150 kN

C

12m

B

A

8m   12m   20m

Figure 4

6. Determine the tension in each segment of the cable supporting two concentrated loads, as shown in Figure 5. Also, determine the total length of the cable and sag at B? (10)
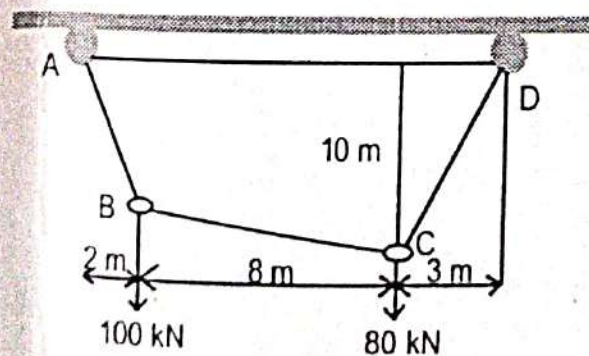
A

D

10 m

B

C

2 m   8 m   3 m

100 kN   80 kN

Figure 5

[P.T.O.]

SECTION - D

7. For the beam shown in Figure 6, draw the influence lines for Ay, Cy, MB and VB using Muller-Breslau Principle.   (10)
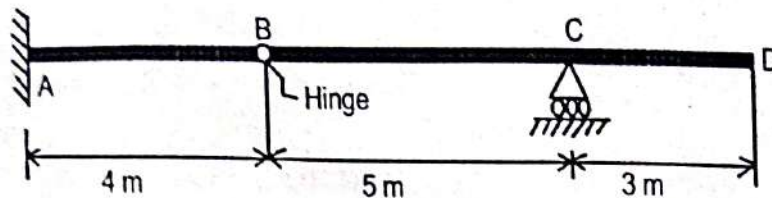

Figure 6

8. Construct the influence lines for bending moment at support B, for the overhang beam shown in Figure 7.   (10)
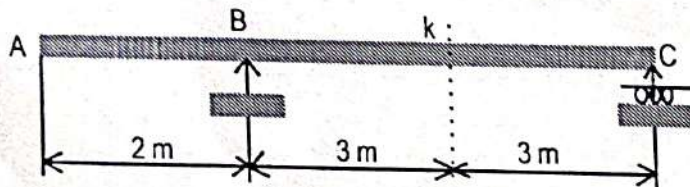

Figure 7

SECTION - E (Compulsory)

9. (a) What is the difference between determinate and indeterminate structures?

   (b) Define 'Castigliano's theorem' and its application in structural analysis.

   (c) What is the principle of minimum potential energy in structural analysis?

   (d) How can you determine if a truss is statically determinal unstable?

   (e) What is the shape of a cable under a uniformly distributed load?

   (f) What are the key steps in constructing an influence line for a reaction in a beam?

(g) Define the term 'static indeterminacy.'

(h) Where is the shear force zero in a simply supported beam?

(i) What is the formula for maximum deflection in a simply supported beam with a uniformly distributed load along the entire length?

(j) What is the method of sections in truss analysis?

$(10×2=20)$