Total number of printed pages:5 **Programme(UG)/5th/UCE503**

2024

STRUCTURAL ANALYSIS

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

*Answer **any five** questions out of six.*

1. a) Define moment area theorems 2 x 2=4

   b) Find the rotation and deflection at the free end in the cantilever beam shown in figure 1 by moment area method. 8

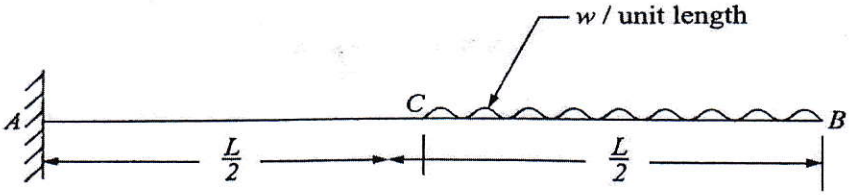

Fig. 1

   c) Determine the slope and deflection at the free end of the cantilever beam as shown in figure 2. 8

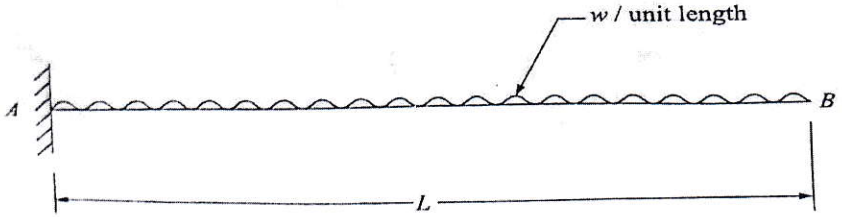

Fig. 2

2. a) Define conjugate beam. Also define the conjugate beam theorems. 2+1+1=4

b) Determine rotation at A, B and deflection at the midspan in the beam as shown in figure 3. Take EI = 4000 KNm^2. 8

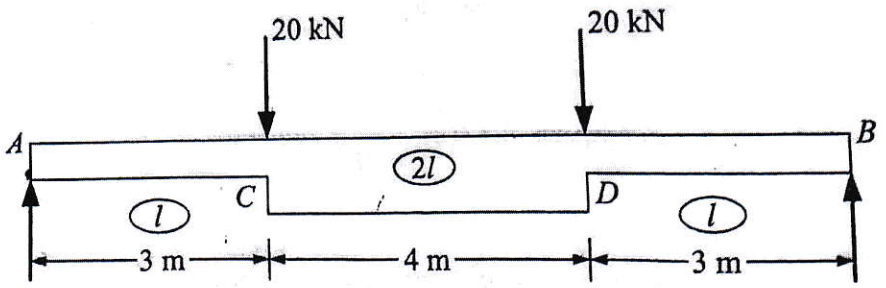

Fig. 3

c) Determine the rotation at B and deflections at E in the beam shown in figure 4. Use conjugate beam method. 8

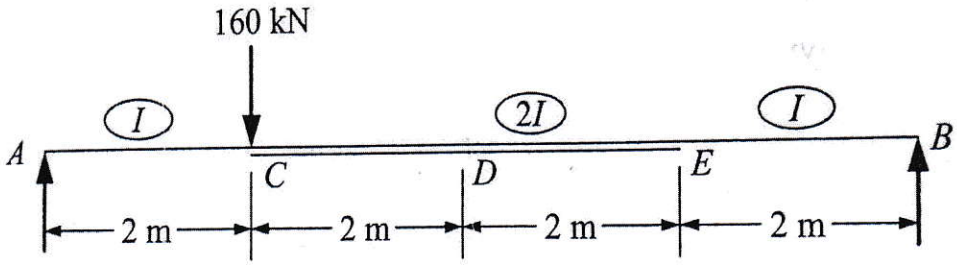

Fig. 4

3. a) Define strain energy. 2

b) Determine the vertical deflection of point C in the frame shown in figure 5. Given E = 200 KN/mm^2 and I = 30 × 10^6 mm^4. Use strain energy method. 8

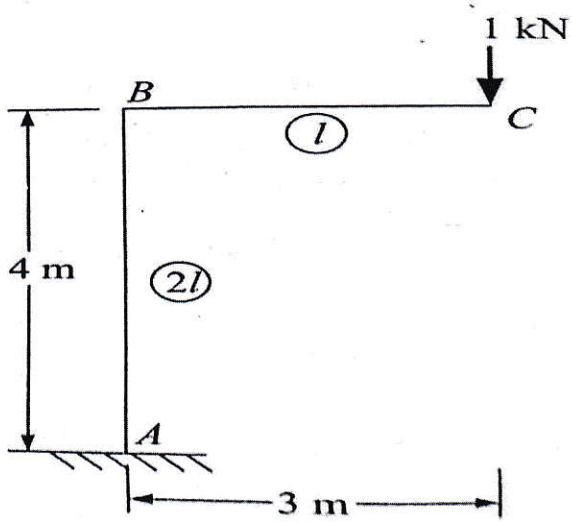

Fig. 5

c) Determine the horizontal displacement of the roller end D of the portal frame shown in figure 6. EI is 10000 KNm^2 throughout. Use strain energy method. 10

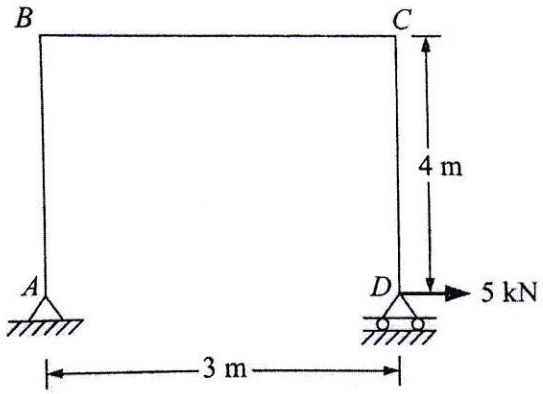

Fig. 6

4. Determine the vertical and the horizontal deflection at the free end of the bent shown in figure 7. Assume uniform flexural rigidity EI throughout. Use unit load method. 20

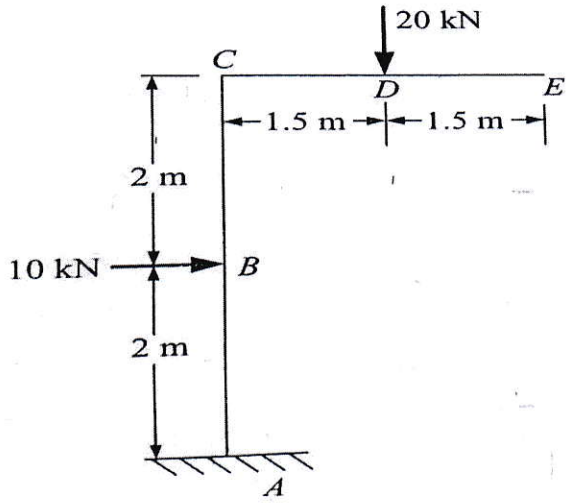

Fig. 7

5. Find the vertical deflection of the joint B in the truss loaded as shown in figure 8. The cross-sectional area of the members in mm are shown in brackets. Consider E = 200 KN/mm^2. 20

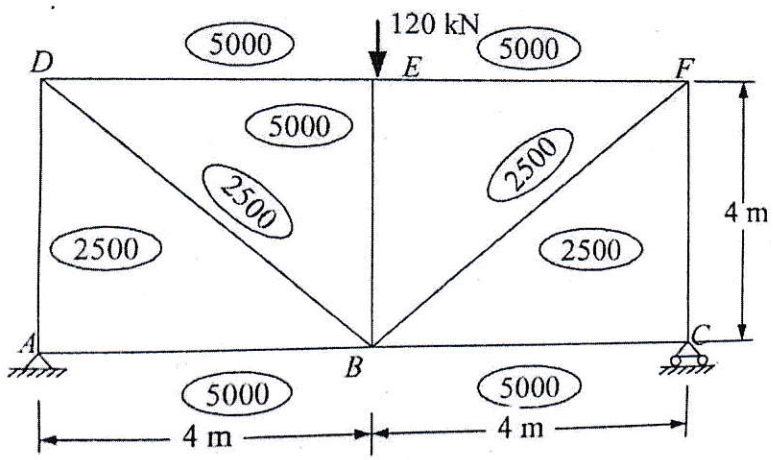

Fig. 8

6. a) With the help of a schematic diagram of a typical arch bridge, define different terminologies associated with a three hinged arch. 5

   b) A three hinged circular arch hinged at the springing and crown points has a span of 40 m and a central rise of 8 m. It carries a uniformly distributed load of 20 KN/m over the left half of the span together with a 15

concentrated load of 100 KN at the right quarter span point. Find the reactions at the supports, normal thrust and shear at a section 10 m from the left support. Refer figure 9.

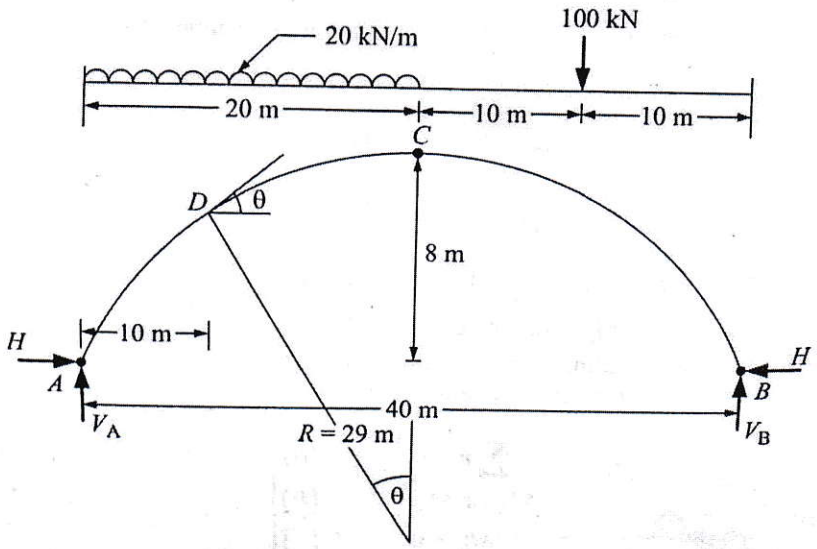

Fig. 9

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