Total No. of printed pages = 6

19/5th Sem/UCE503

2021

STRUCTURAL ANALYSIS – I

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. 2×2=4

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

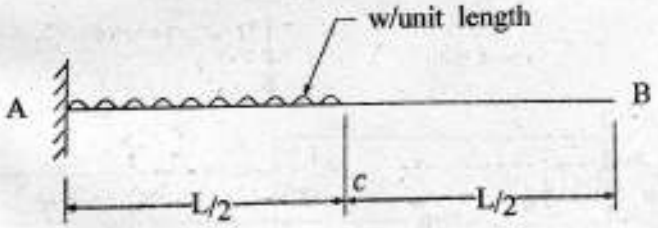

Fig. 1

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

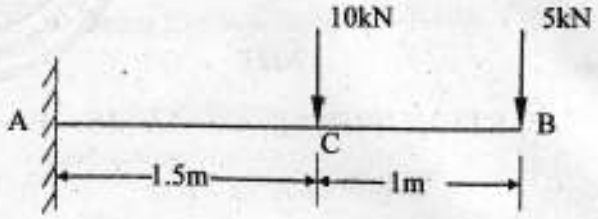

Fig. 2

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

(b) Determine rotation at A, C and deflection at C in the beam as shown in figure 3 using conjugate beam method. 8

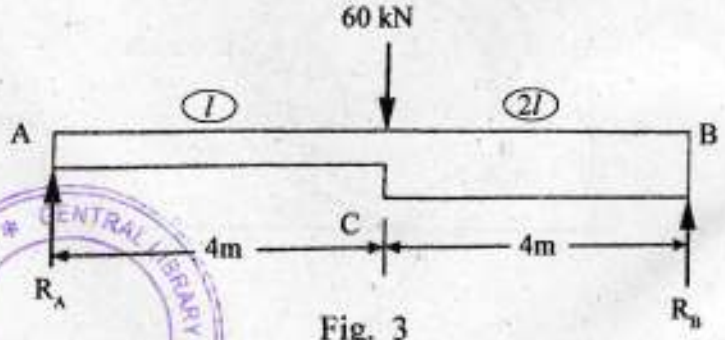

Fig. 3

(c) Determine the rotations at A, B and deflections at D, E in the beam shown in figure 4 using conjugate beam method. 8

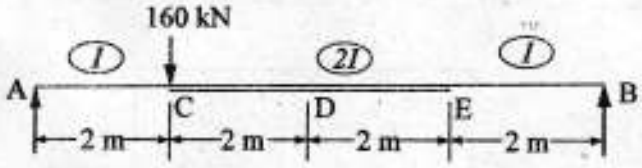

Fig. 4

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/mm² and I = 30×10^6 mm⁴. Use strain energy method. 8

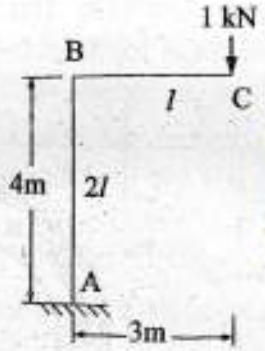

Fig. 5

(c) Determine the horizontal displacement of the roller end D of the portal frame shown in figure 6. EI is 10000 kNm² throughout. Use strain energy method.. 10

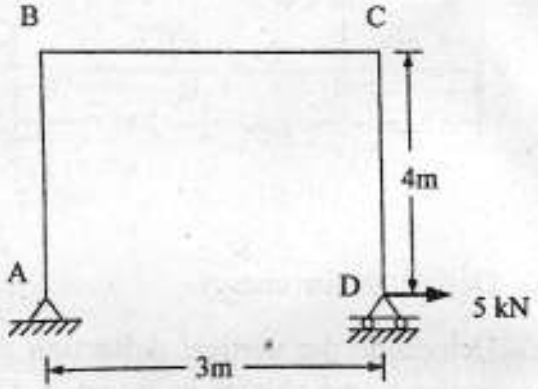

Fig. 6

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

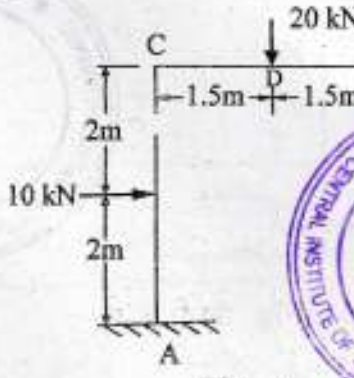

Fig. 7

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/mm². 20

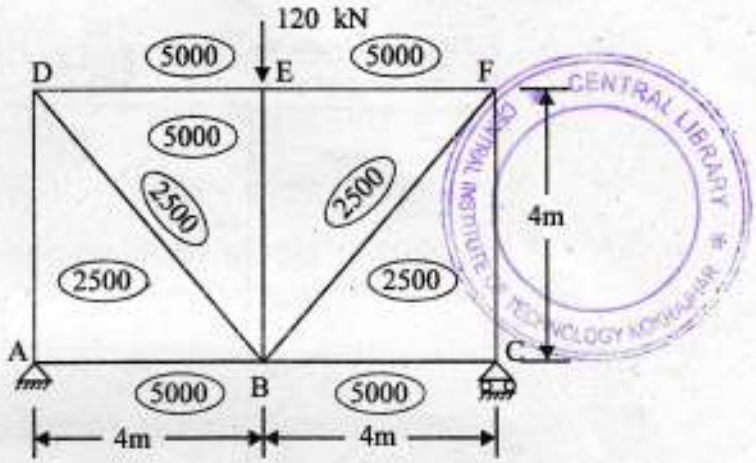

Fig. 8

6. (a) With the help of a schematic diagram of a typical arch bridge, define the 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 40m 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

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. 15

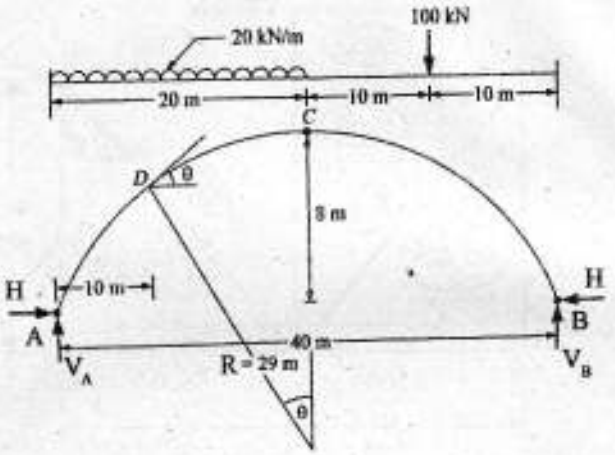

Fig. 9