

N.B. (1) Question No.1 is compulsory.

(2) Attempt **any three** questions out of remaining five questions.

(3) Assume suitable data wherever required and state it clearly.

1. Attempt any **four** of the following:

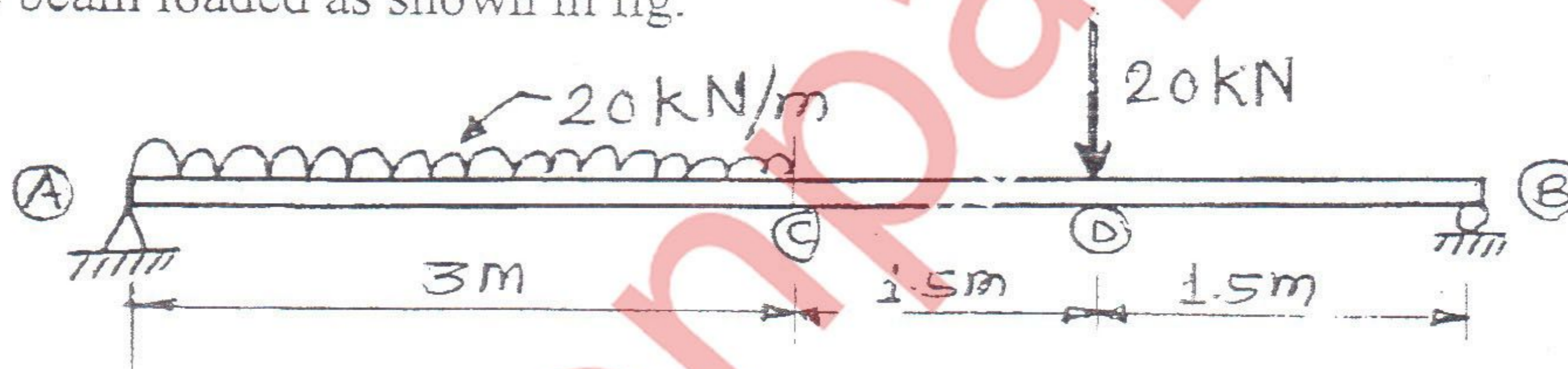
(a) In three hinged parabolic arch subjected to UDL over entire span, show that bending moment & radial shear at any section is zero. 05

(b) Find the strain energy stored due to bending in cantilever beam subjected to UDL of intensity  $w$  kN/m over entire span. 05

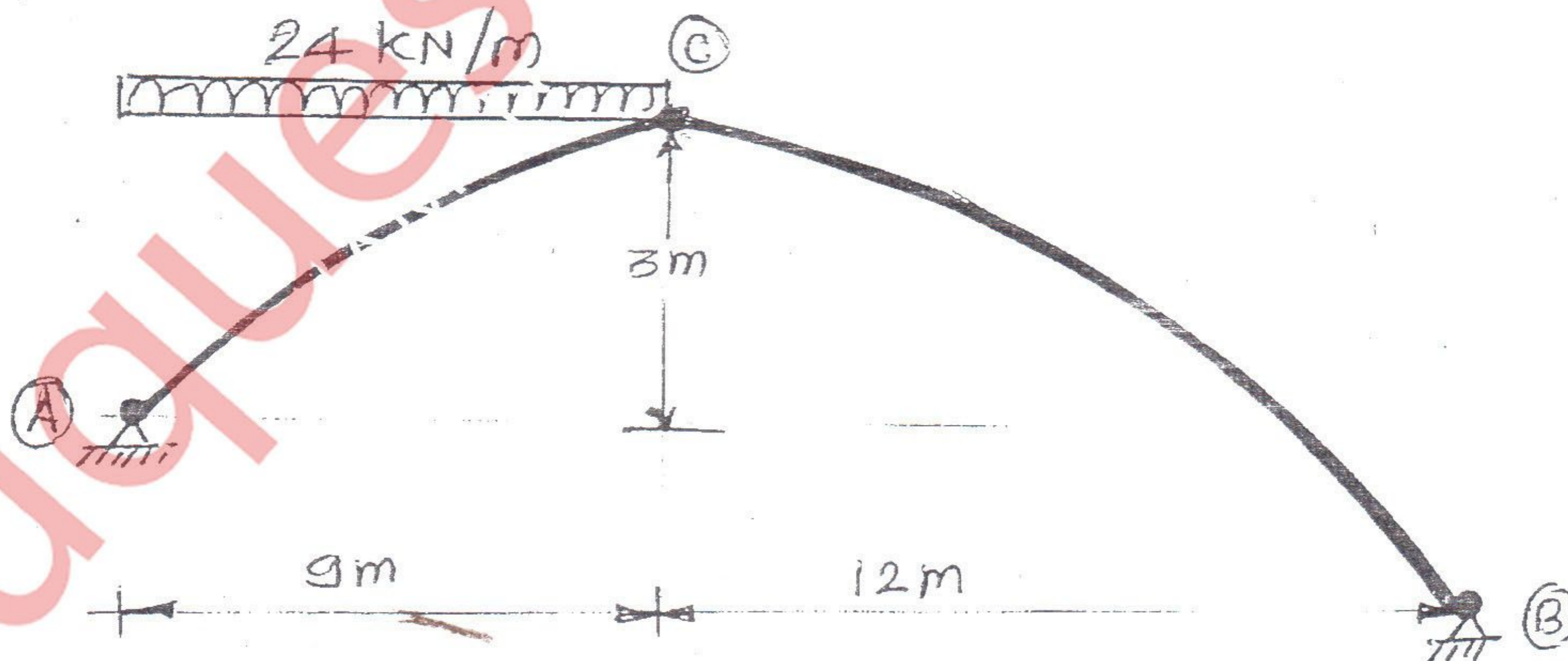
(c) Define influence line diagram and give its application in civil engineering. Draw ILD for Reaction, S.F and B.M for Simply supported beam. 05

(d) A symmetrical cable of span 50 m and central dip of 5 m subjected to udl of intensity 20kN/m. Find the maximum and minimum tension in the cable. 05

(e) Using Macaulay's method determine maximum deflection and slope at supports for the beam loaded as shown in fig. 05



2. (a) An unsymmetrical three hinged parabolic arch is loaded as shown in fig. Determine: Support reaction, BM, NT and RSF at 5 m from left support. Also find maximum bending moment in left part and right part. 13

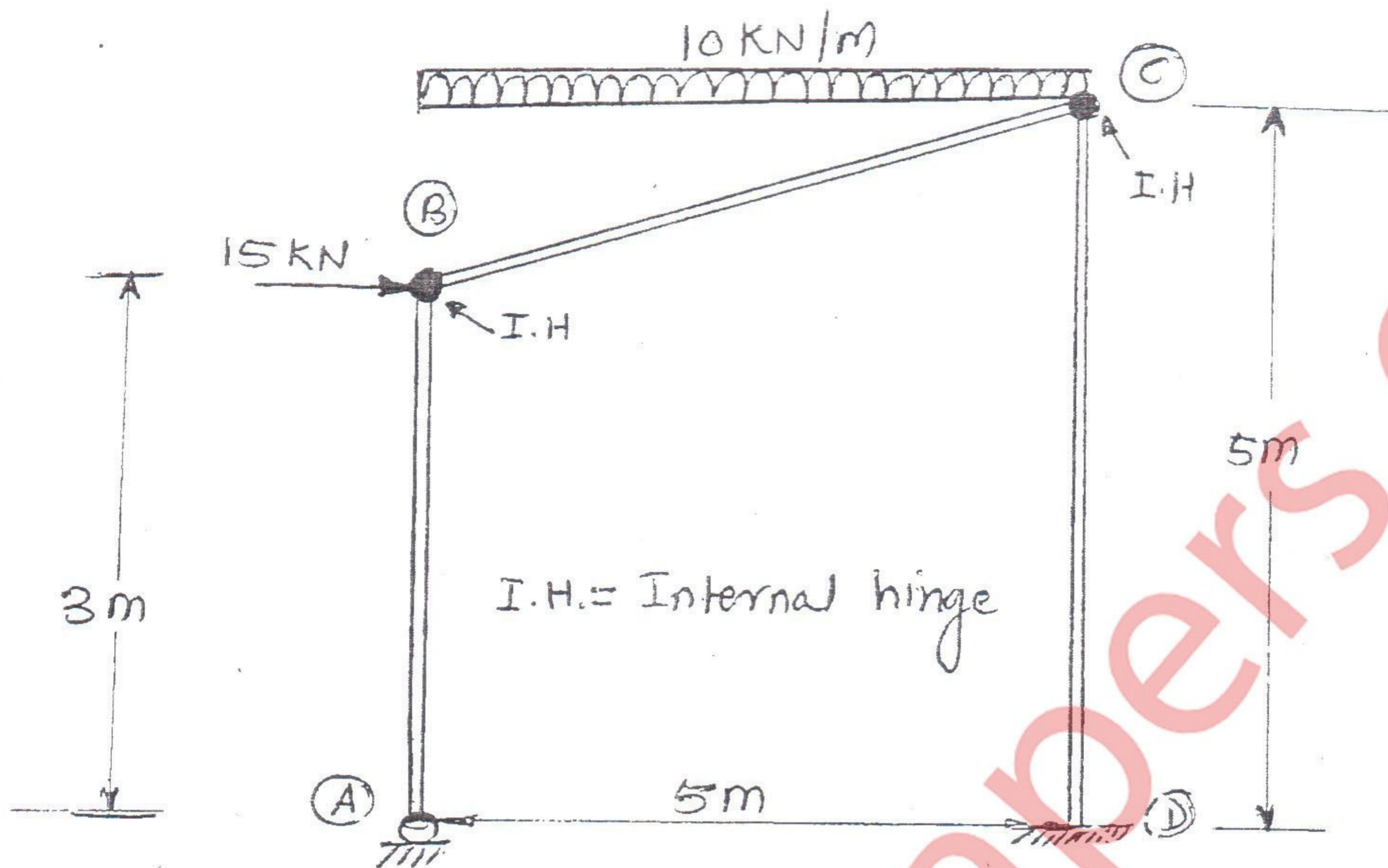


(b) State and explain Maxwell's Reciprocal theorem and Betti's theorem. 04

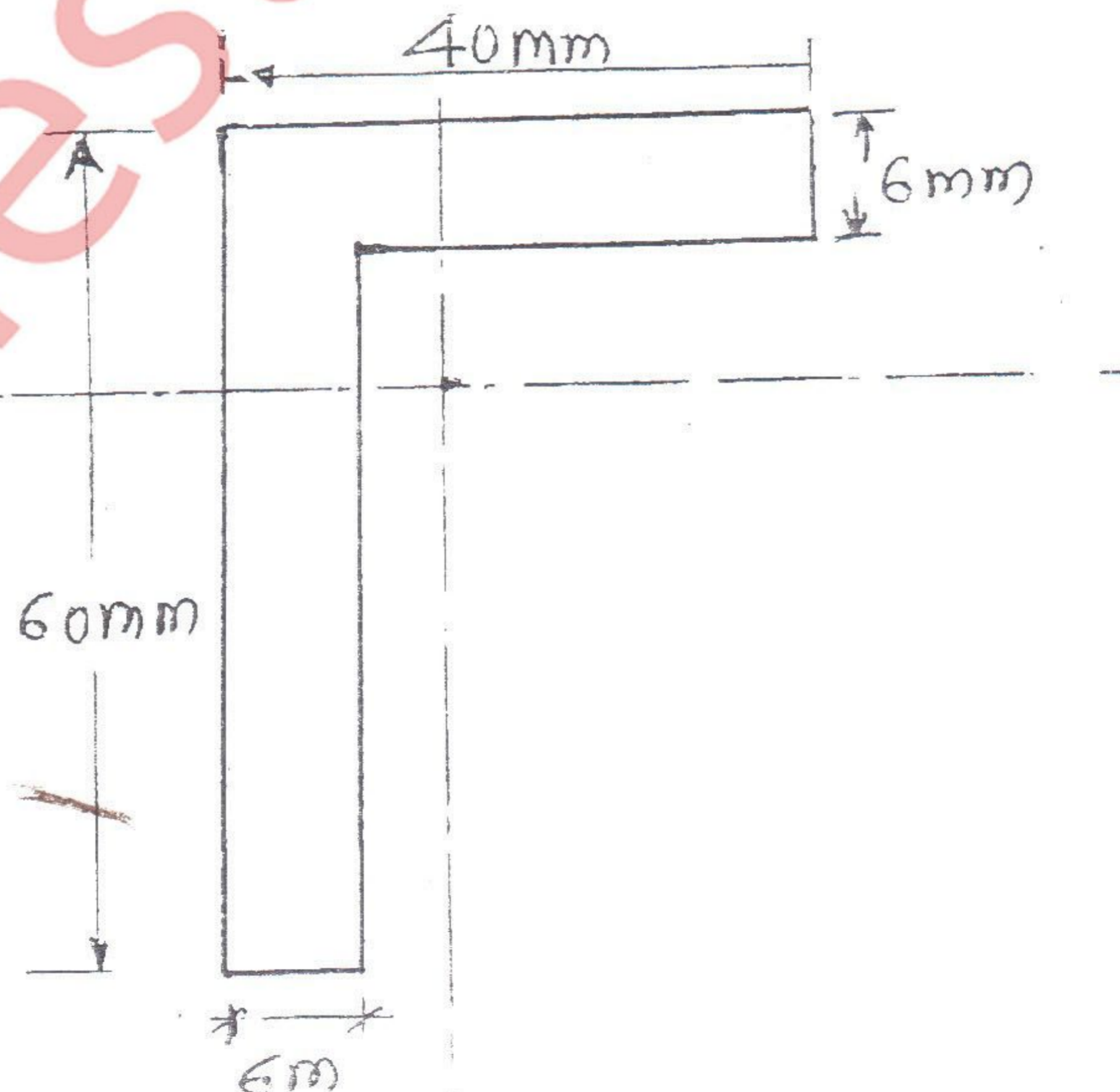
(c) State Moment Area I<sup>st</sup> and II<sup>nd</sup> theorem. 03

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3. (a) Draw neat sketch of cable and suspension bridge. Show all the components of suspension bridge and explain what type of internal forces developed in each component. Also explain different types of cable supports. 08
- (b) Draw AFD, SFD and BMD for the frame loaded as shown in fig. 12

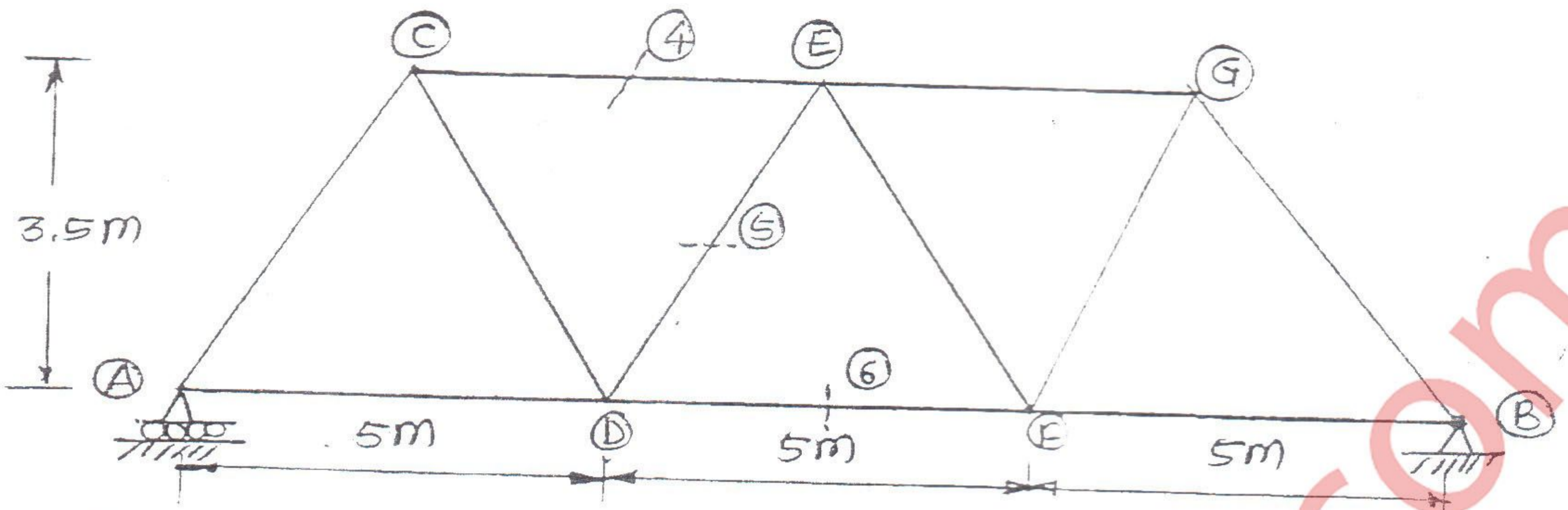


4. (a) A simply supported girder of span 50 m is traversed by a series of wheel loads 160 kN, 200 kN, 180 kN and 140 kN spaced at distances 2 m, 1.5 m and 1 m respectively. The load system moves from left to right with 140 kN load leading. Find the location and magnitude of absolute maximum bending moment anywhere in the girder. 08
- (b) Determine Principal moment of inertia for the section as shown in fig. Also locate principal axes. 06

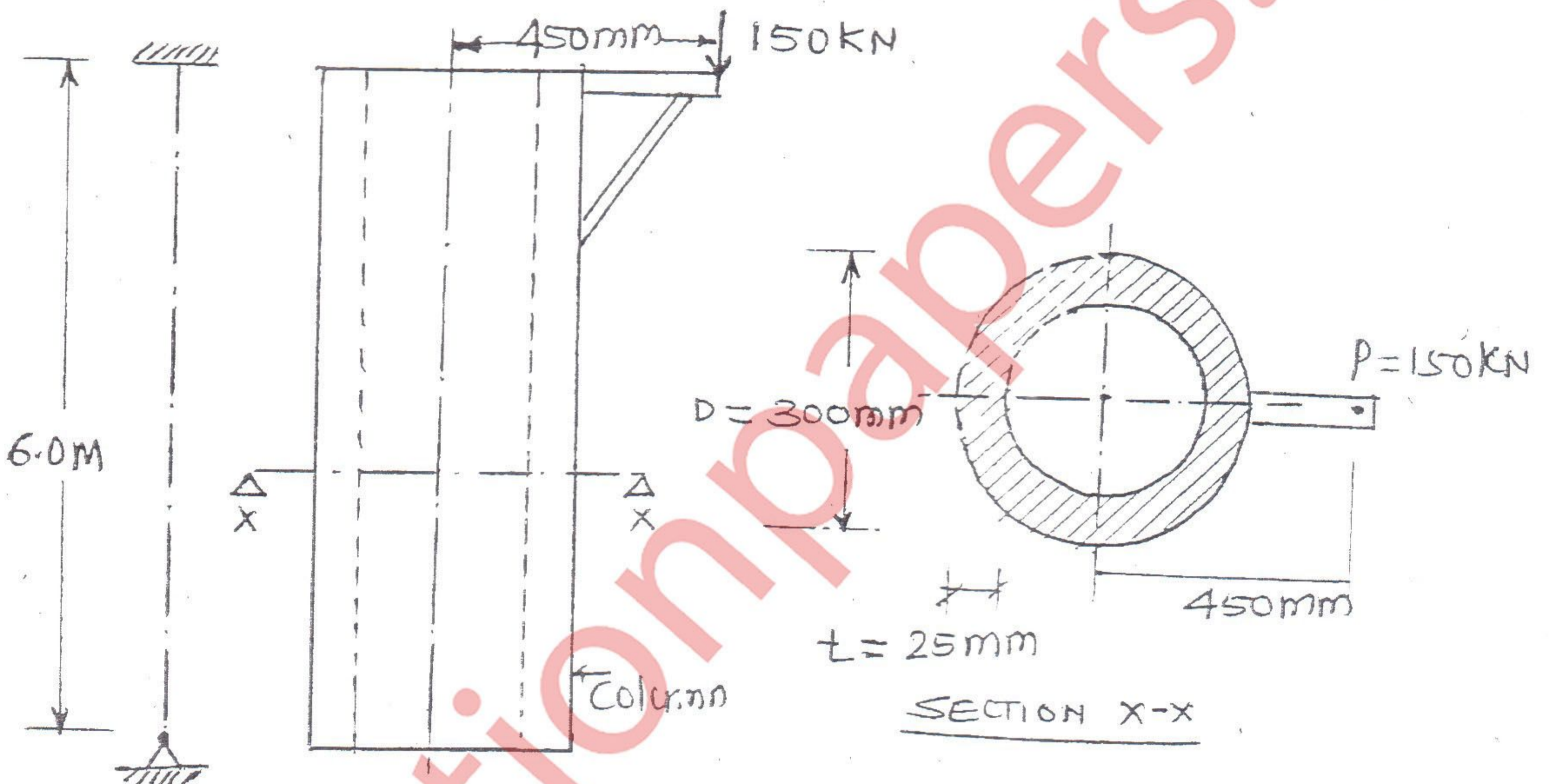


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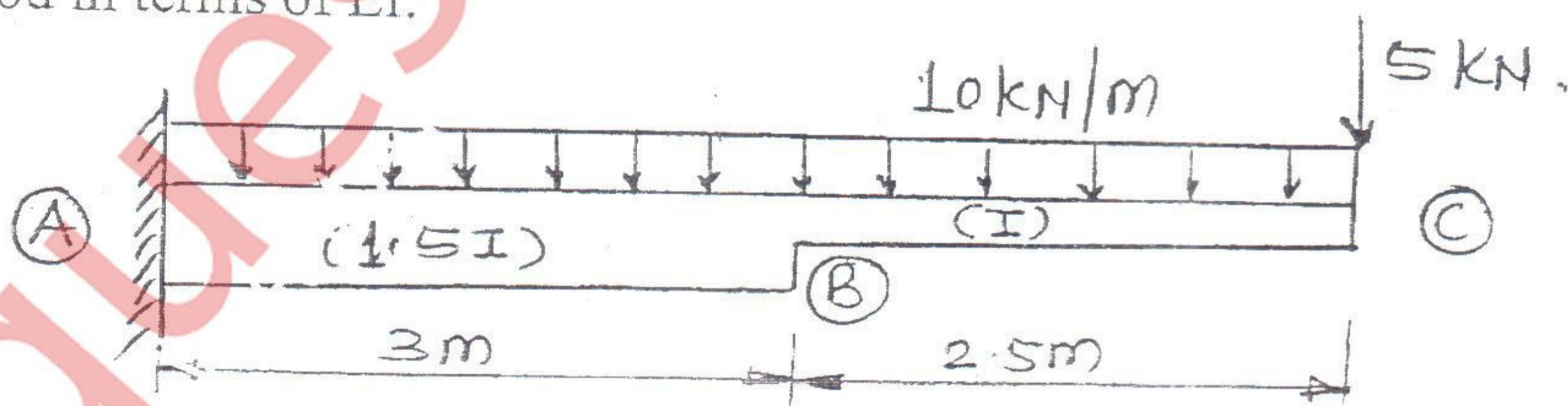
- (c) Draw I.L.D for members 4, 5 and 6 of the truss as shown in fig. Assume that load moves along the bottom chord.



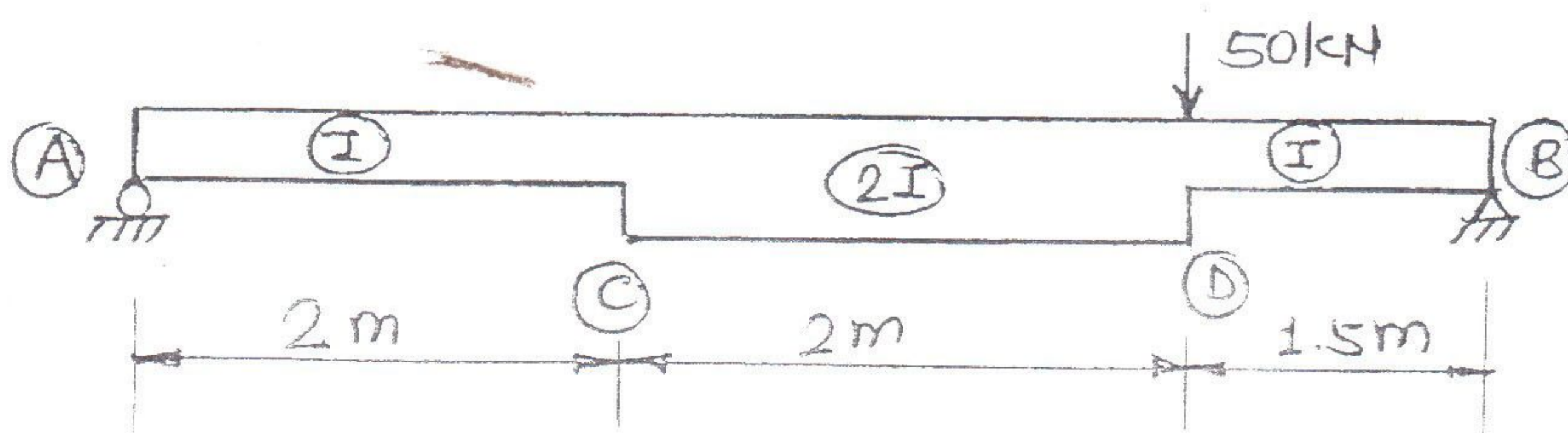
5. (a) Find the maximum and minimum stresses developed at the base of a column loaded as shown in fig. Also draw stress distribution. Take  $E = 2 \times 10^5 \text{ N/mm}^2$ .



- (b) Determine the maximum deflection of the cantilever beam by Moment Area Method in terms of EI.



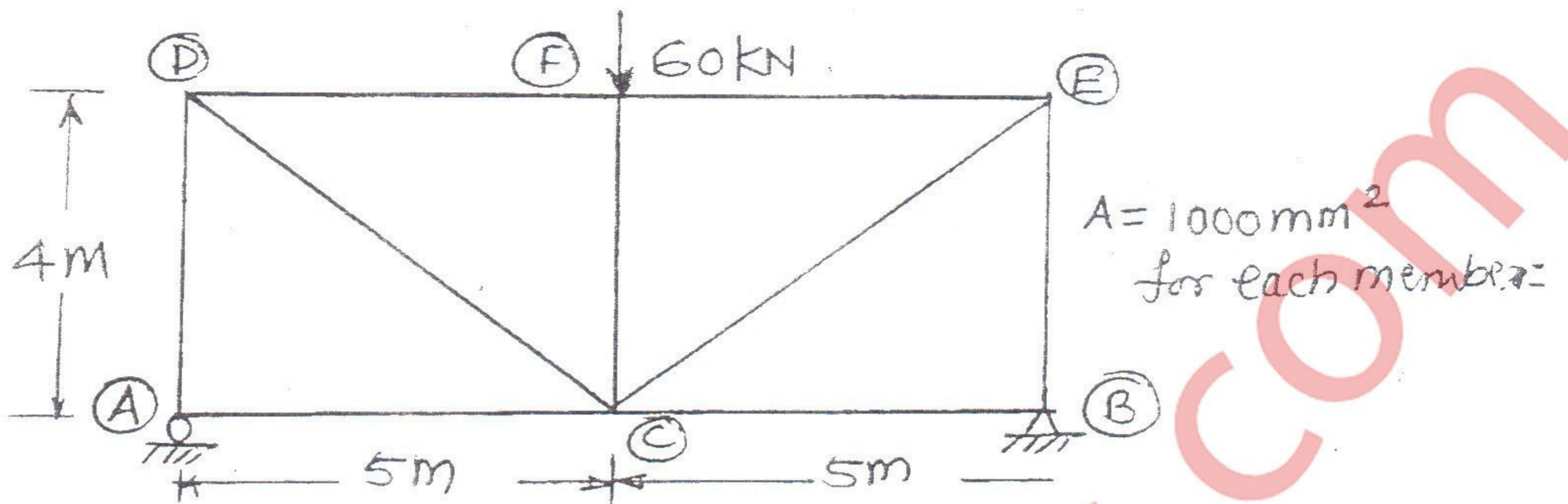
- (c) Using Conjugate Beam Method find the vertical deflection at D and slope at A for the S.S. beam loaded as shown in fig. in terms of EI.



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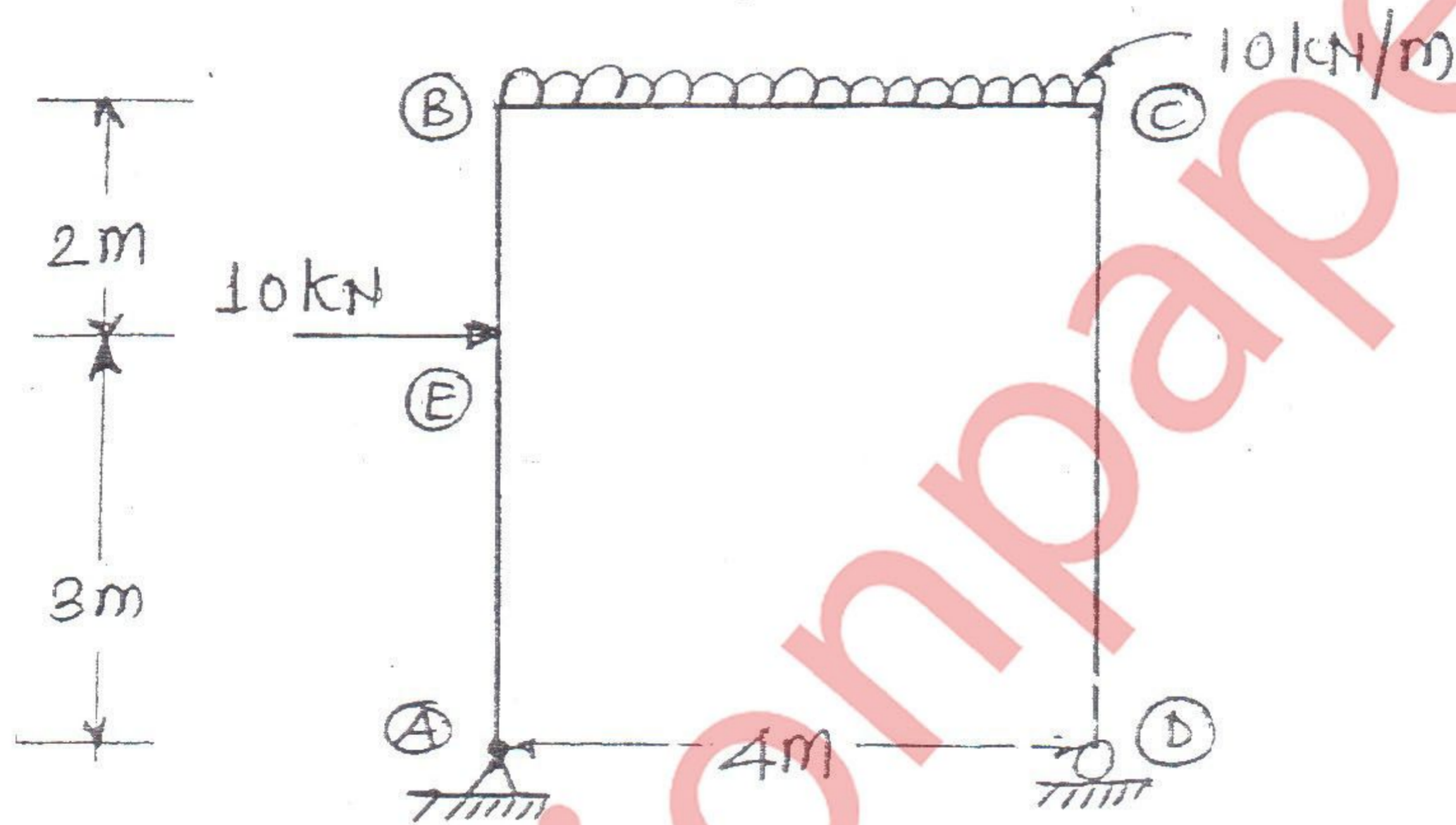
6. (a) Attempt any ONE of the following

- (i) Find the vertical deflection in the frame as shown in fig. by Unit Load Method or any other Energy Method at point C. ( $EI = \text{constant}$ )



- (ii) Using Unit Load Method or Castigliano's second theorem, for rigid jointed frame as shown in fig. Find horizontal displacement of roller support.

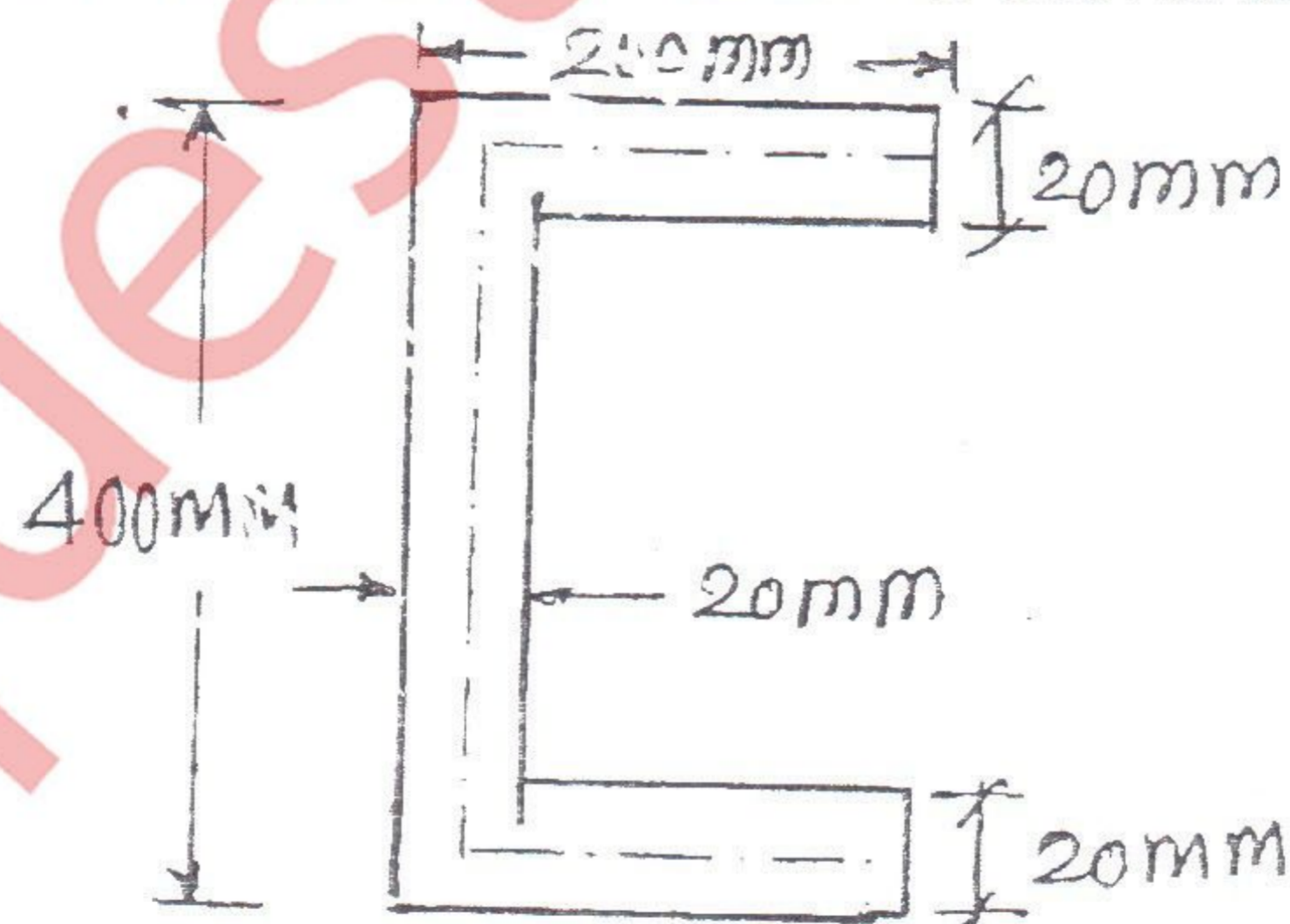
Take  $E = 210 \times 10^3 \text{ N/mm}^2$ ,  $I = 2 \times 10^8 \text{ mm}^4$



(b) Explain Concept of Shear Centre in brief.

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Determine shear center for a C section as shown in fig.



- (c) A simply supported beam of triangular section, 150 mm base width and 200 mm height, supports a concentrated load of 5 kN at centre of span of 3 m. The plane of loading is inclined at an angle of  $30^\circ$  to the vertical plane of symmetry. Find out the bending stress at each of the corner points of the cross section.