SE Civil IV CBGS 25.5.16 (165)

SA-I

QP Code :539101

(3 Hours) **[Total Marks: 80**

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

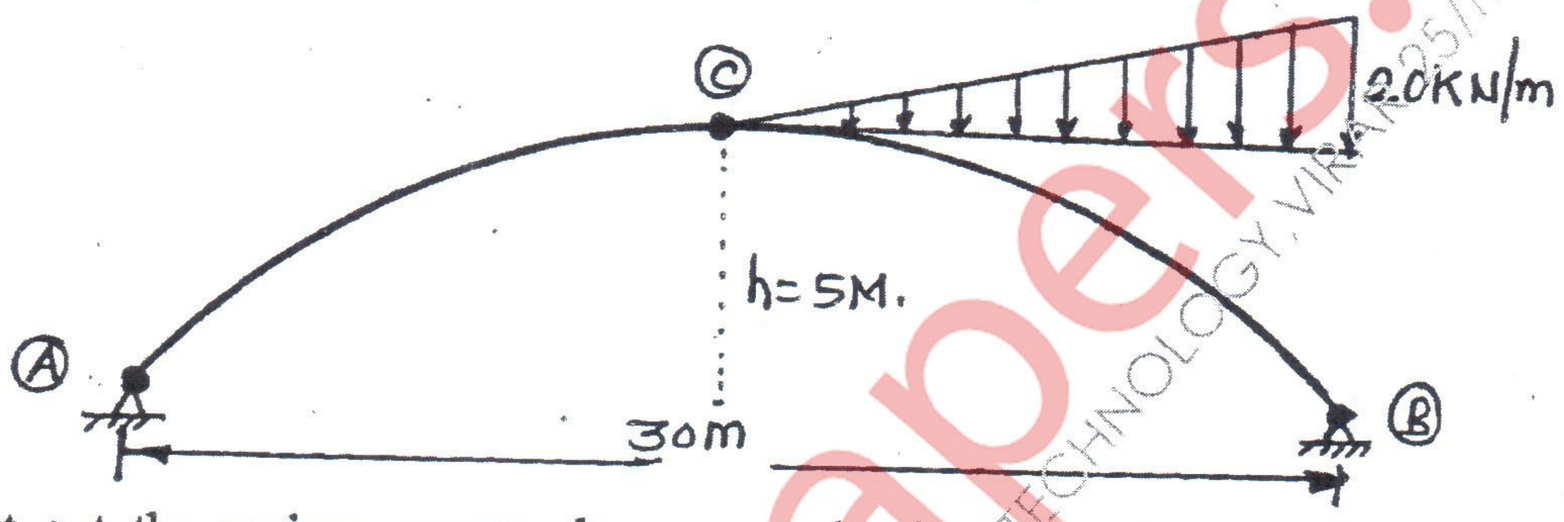
(2) Attempt any **three** questions out of remaining five questions.

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

(4) Illustrate your answers with neat component sketches wherever required.

1. Attempt any four of the following

(a) Differentiate the behavior of beam and an Arch. Find the reaction components for three hinged parabolic arch loaded as shown in figure **05**

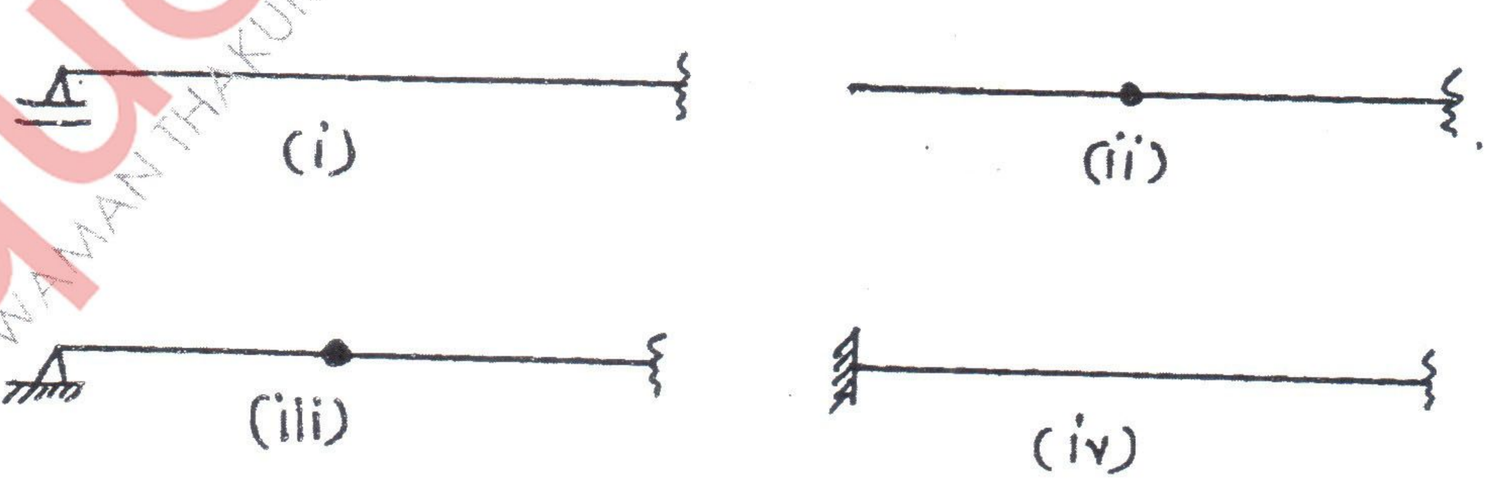


(b) List out the various energy theorems and principles related to the elastic structures. Explain any one of them. **05**

(c) Explain the terms: (i) Product of inertia (ii) Unsymmetrical bending (iii) Shear center **05**

(d) Explain the function of each component of a suspension bridge consisting of suspension cable and three hinged stiffening girder. A symmetrical cable of span 40m with central dip 5m is loaded with udl of 25 kN/m. Find the maximum and minimum tension in the cable. **05**

(e) Define a conjugate beam. State Mohr's theorem I and II to determine displacement in a structure related to conjugate beam. Convert the following real beams in to the conjugate beams; **05**



(f) Explain ILD and state its importance in structural analysis. Draw ILD for reactions, S.F and B.M for S.S beam. **05**

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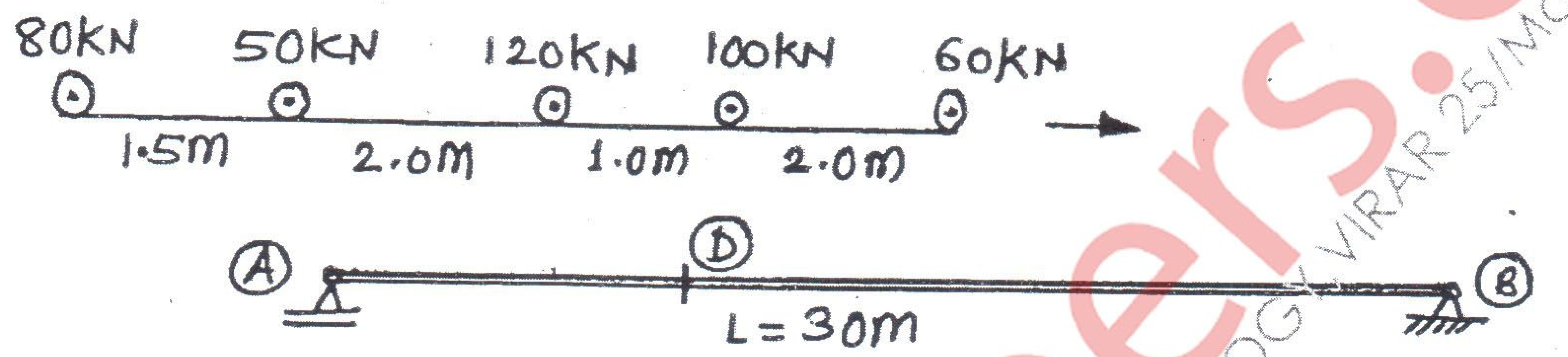
2. (a) A three hinged circular arch of span 30 m with central rise of 6 m carries a concentrated point load of 10 kN at 10 m from left hinge. Calculate; Support reactions, Maximum positive and negative Bending moment (Draw neat sketch). Also find Normal thrust and radial SF at left quarter point. **10**

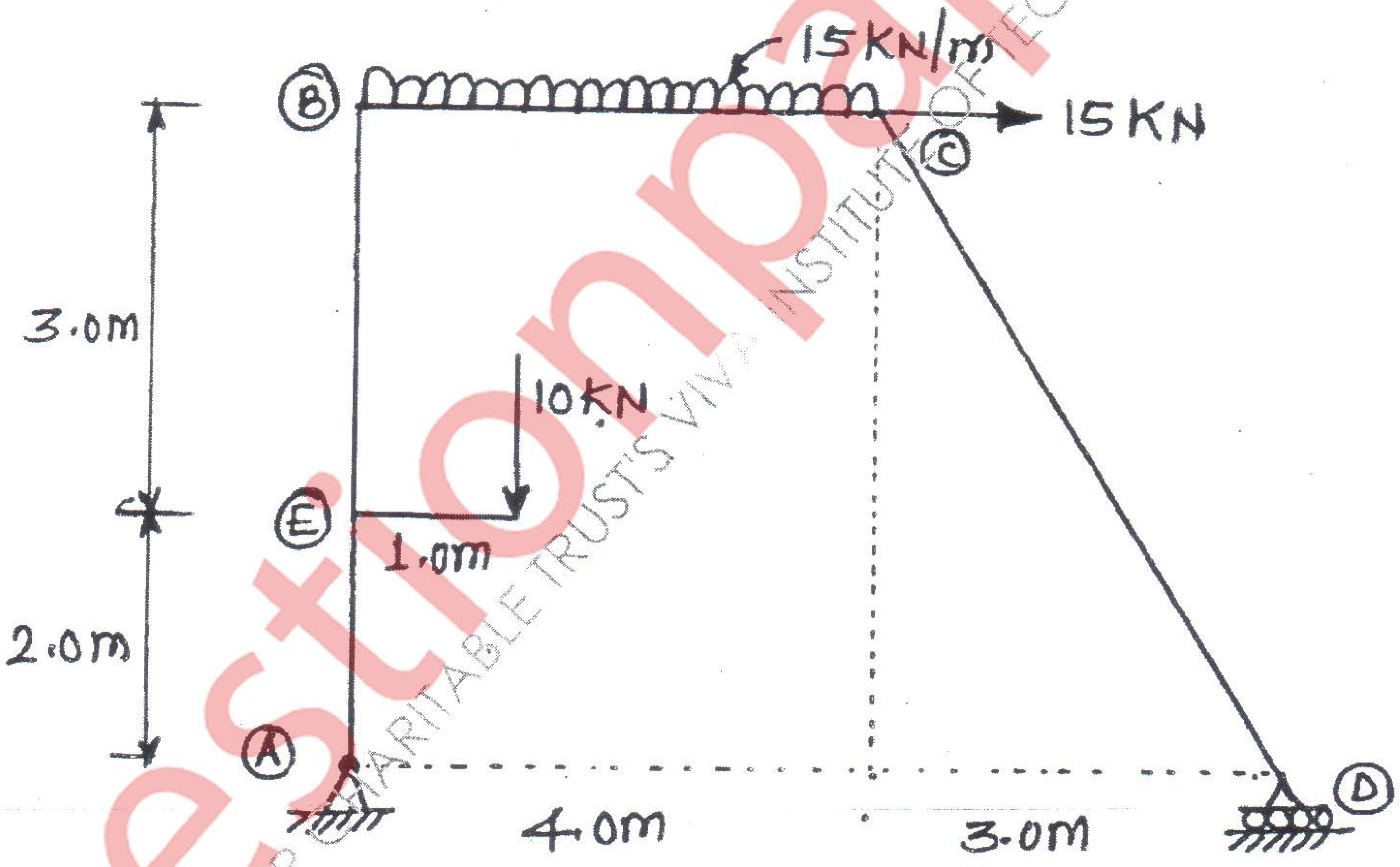
(b) A simply supported girder AB of span 30 m is traversed by a system of wheel load as shown in figure. Calculate; **10**

(i) Maximum BM at section 'D' 10 m away from the left support.

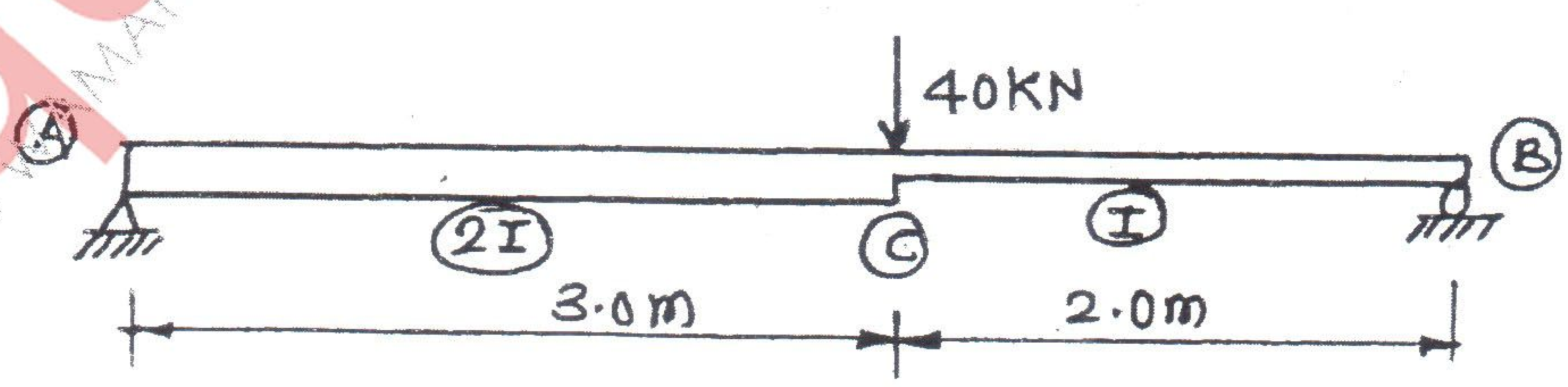
(ii) Location and magnitude of absolute maximum BM.



3. (a) For the plane frame as shown in figure. Draw free body diagram of each member and construct AFD, SFD and BMD. **13**



(b) Using conjugate beam method find the vertical deflection at C and slope at B for the simply supported beam loaded as shown in figure. **07**



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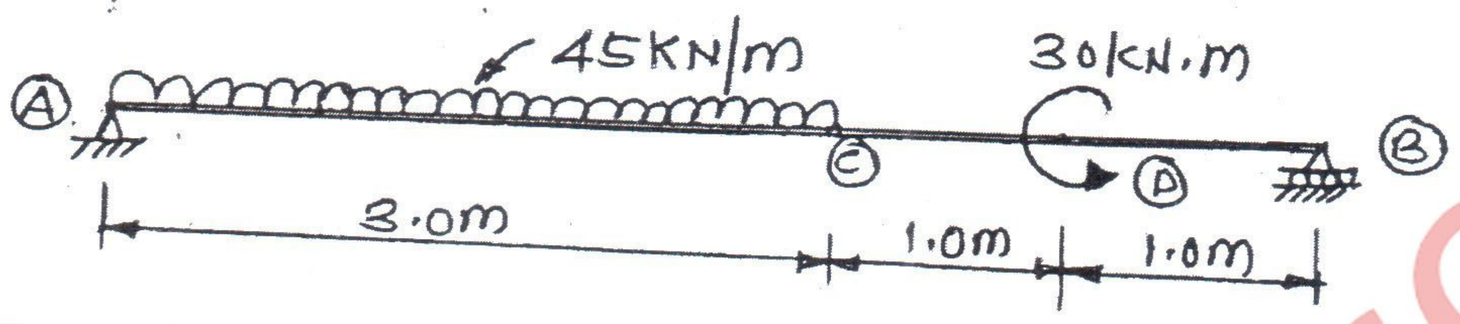
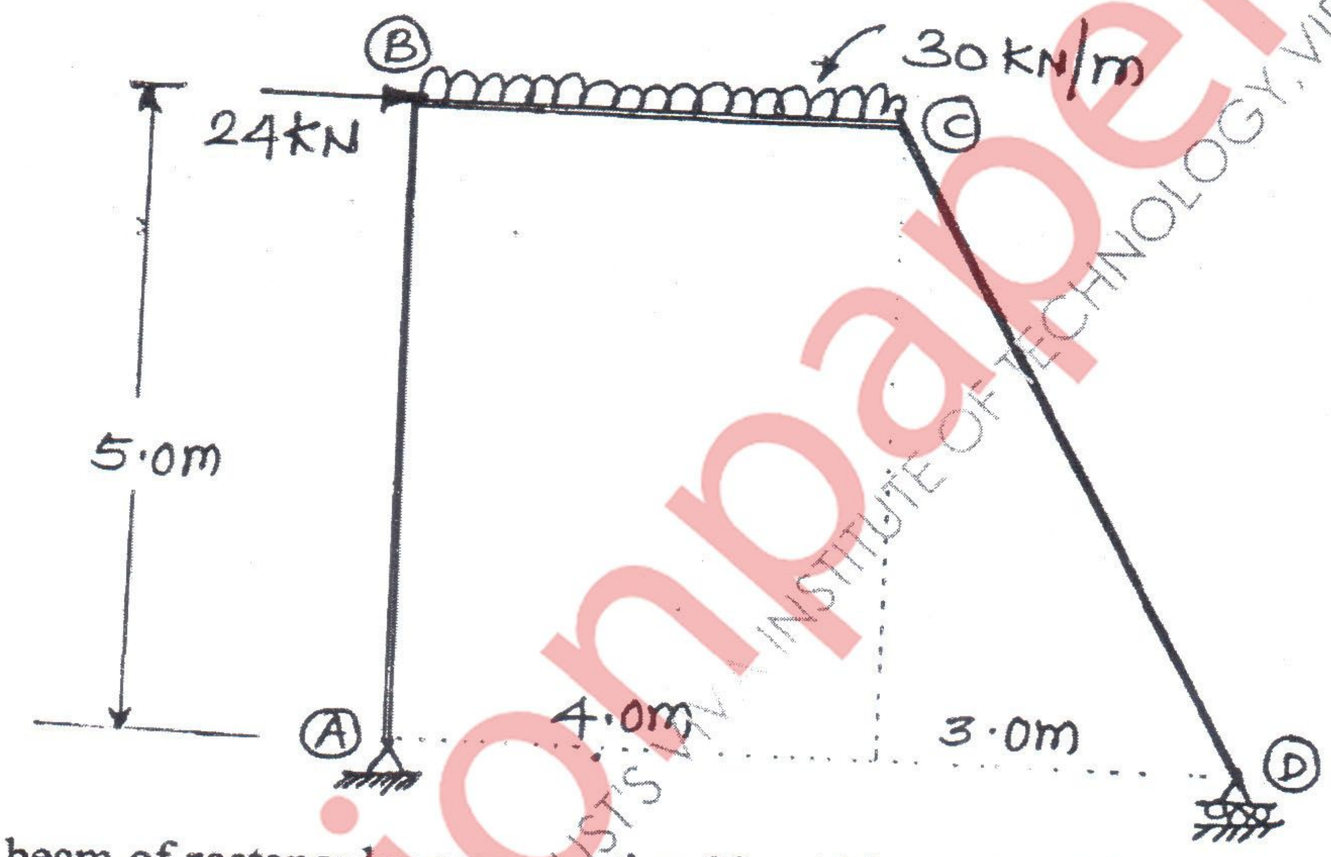
4. (a) Using Macaulay's method, determine maximum deflection and slope at the supports. Take EI = Constant. **06**



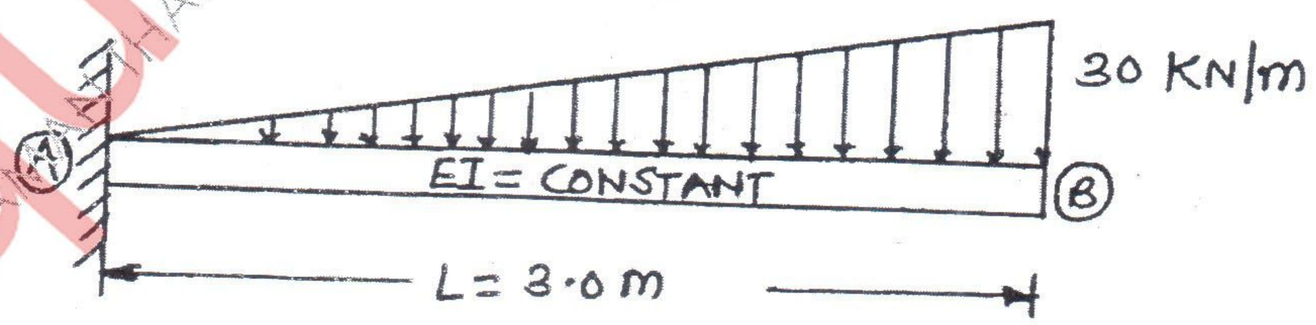
(b) Define strain energy. Write the expression for strain energy stored due to shear force, bending moment and twisting moment. **04**

(c) Using unit load method or Castigliano's second theorem, for the rigid jointed frame shown in fig. Calculate a horizontal displacement of roller support at D. Take E = 200 Gpa. I = 4×10^8 mm^4. **10**



5. (a) A beam of rectangular cross section 80 × 120 mm is subjected to a uniformly distributed load of 10 kN/m. The plane of loading makes an angle of 30° with respect to y-y axis. If the span of beam is 6 m, locate the neutral axis and hence find the stresses at each corners of the beam. **07**

(b) Using moment area method, determine the vertical deflection and slope at free end of the beam as shown in figure. **07**



(c) A column of hollow circular section with external diameter 300 mm and thickness 50 mm is 4.5 m long. It is pinned at both the ends. The column carries a load of 180 kN at an eccentricity of 40 mm. Find out the stresses produced at extreme fibre of the column section. Take E = 200 kN/mm^2. **06**

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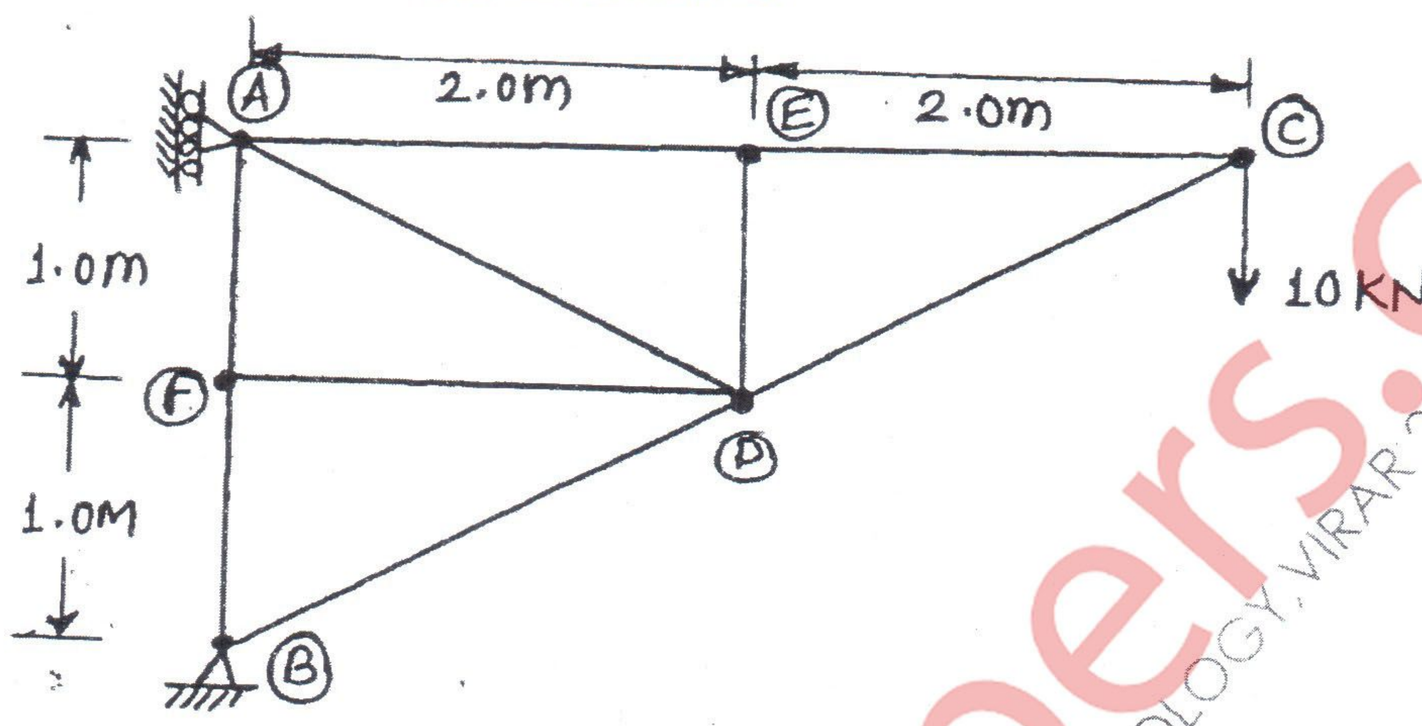
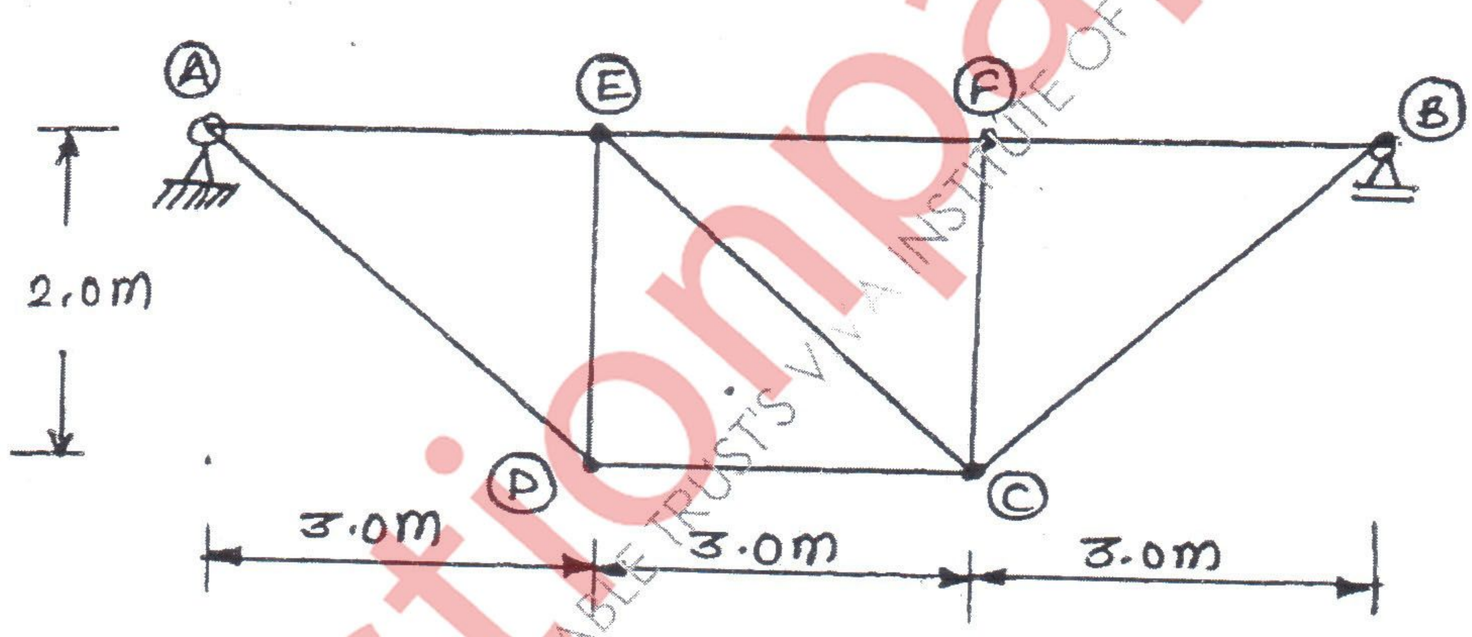
6. (a) Using unit load method or any other energy method, find the vertical deflection of joint C of a pin jointed truss loaded and supported as shown in fig. Take AE = Constant for all members. **08**



(b) Draw ILD for axial force in members ED and EC of a deck type bridge truss as shown in figure. **08**



(C) Prove that shear force (radial shear) at any section of symmetrical three hinged arch subjected to u.d.l over the entire span is zero. **04**