40+40+40+34 +28

25-5-17

195

SE Civil IV CBSGS

QP Code : 13876

(3 Hours) [Total Marks : 80

N.B. : (1) Question No. 1 is compulsory.
(2) Answer any three from the remaining.
(3) Each full question carries equal marks.
(4) Assume suitable data if needed and state it clearly.

1. (a) A three hinged parabolic arch, supported at the same level, carries a UDL (w) throughout its length (l). The central rise is (h). If the rise is halved (i. e. reduced to h/2), prove that the horizontal thrust (H) at the lower hinges gets doubled. 4

(b) For the frame in (Fig. 1), the axial force experienced by the beam BC is (write the correct option) : 2

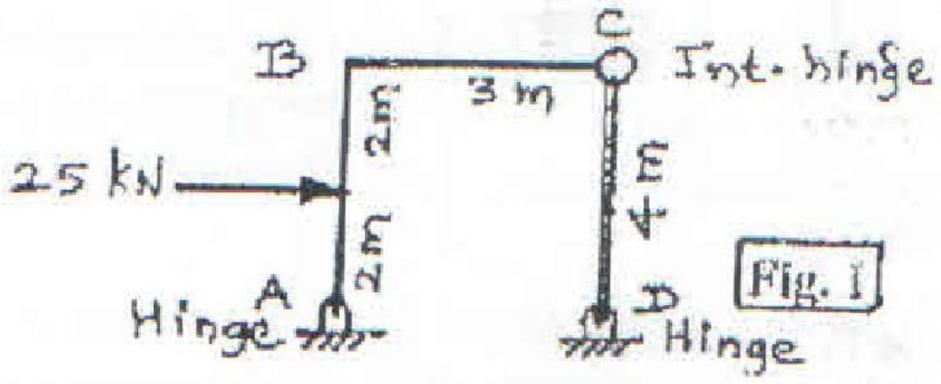

Fig. 1

a) 12.5 kN b) 25 kN

c) Zero d) None of these

(c) Fig. 2 shows a beam with its influence lines for Shear Force & Bending Moment at section 1. The Shear Force & Bending Moment at section 1 due to a point load of 20 kN, placed at mid-span, will be (write the correct option). 2

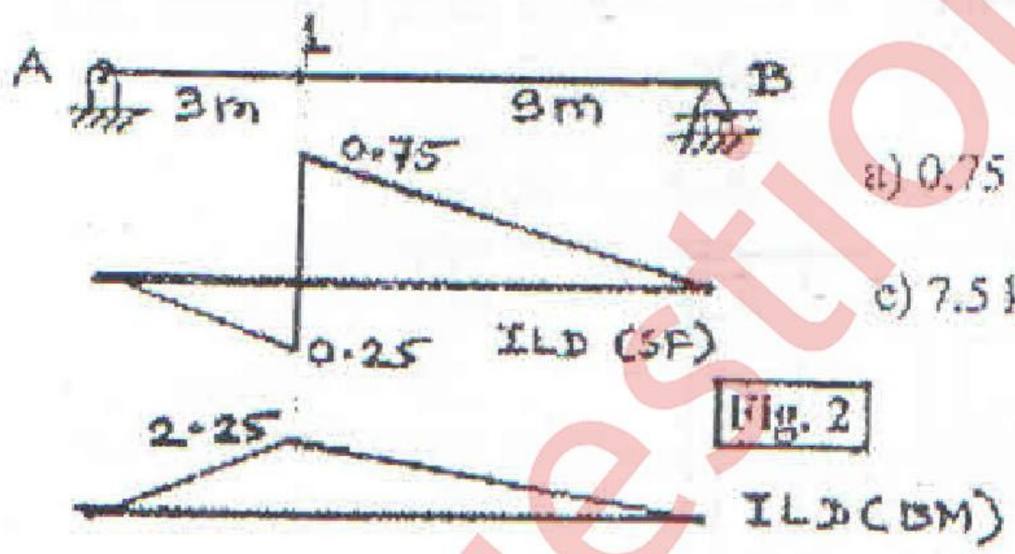

Fig. 2

a) 0.75 kN & 2.25 kNm b) 5 kN & 5 kNm

c) 7.5 kN & 10 kNm d) 10 kN & 30 kNm

(d) A suspension cable having supports at the same level, has a span of 30 m & a maximum dip of 3 m. The cable is loaded with a UDL of 12 kN/m throughout its length. Find the maximum tension in the cable. 4

(e) State the two theorems of Moment-Area Method, with necessary diagrammatic illustrations. 4

(f) Explain the method of virtual work, as applied to beams & frames, to find the rotations and translations. 4

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2. (a) Determine the deflection at point C of the beam (Fig. 3). Use Moment-Area Method. E = 200 GPa & I = (250 X 10^6) mm^4. 8

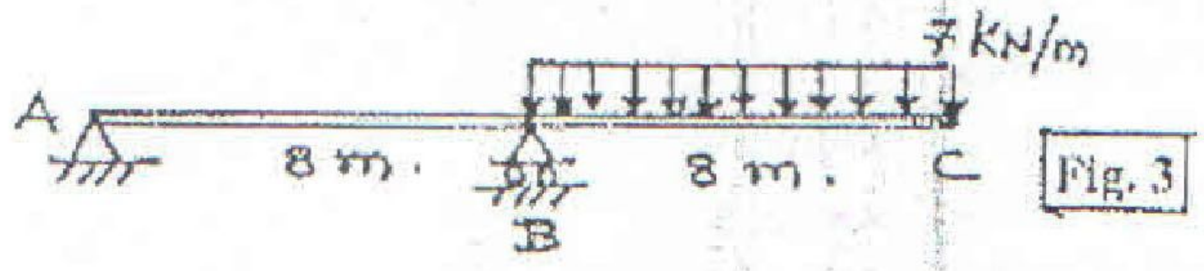

Fig. 3

(b) Draw Axial Force Diagrams, Shear Force Diagrams and Bending Moment Diagrams for each element of the statically determinate rigid jointed plane frame shown in (Fig. 4). 8

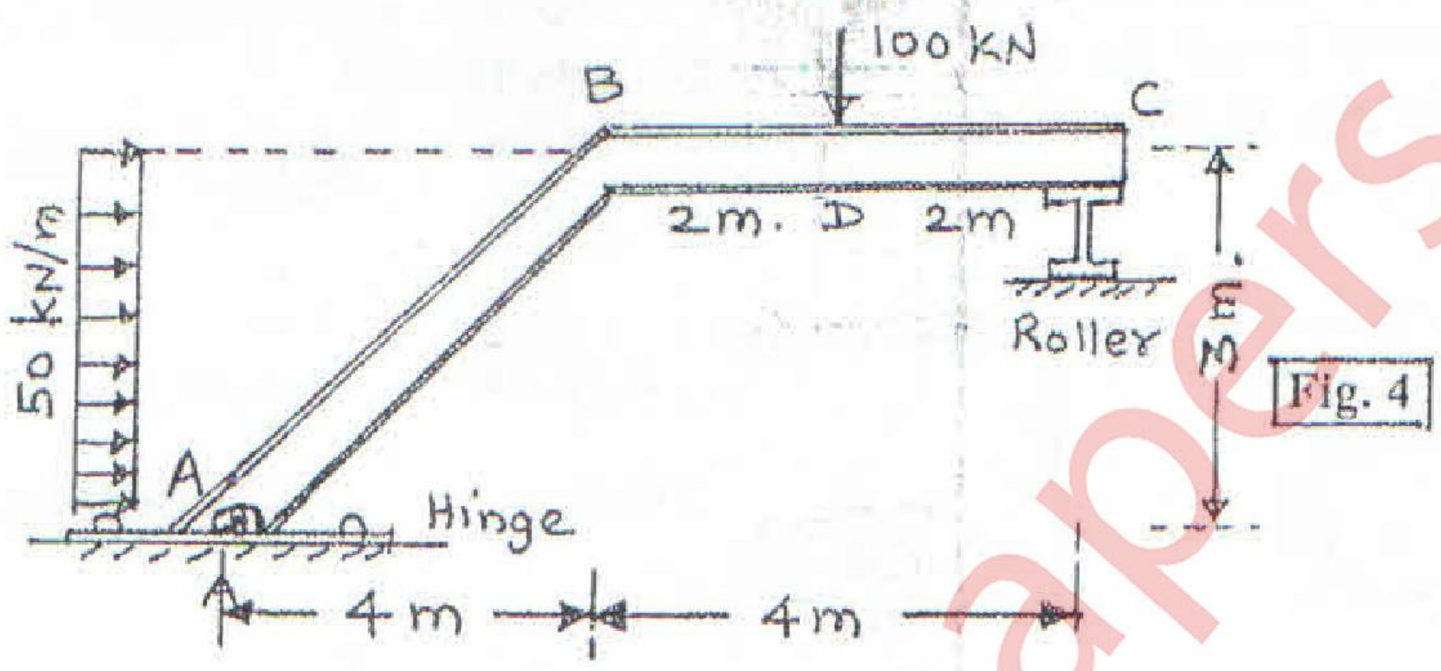

Fig. 4

(c) State the two theorems of Conjugate Beam Method. 4

3. (a) The tree-hinged arch bridge (Fig. 5) has a parabolic shape & supports the UDL. Calculate the Radial Shear, Normal Thrust & Bending Moment at an intermediate point D along its axis. Assume the load is uniformly transmitted to the arch rib ABC. 8

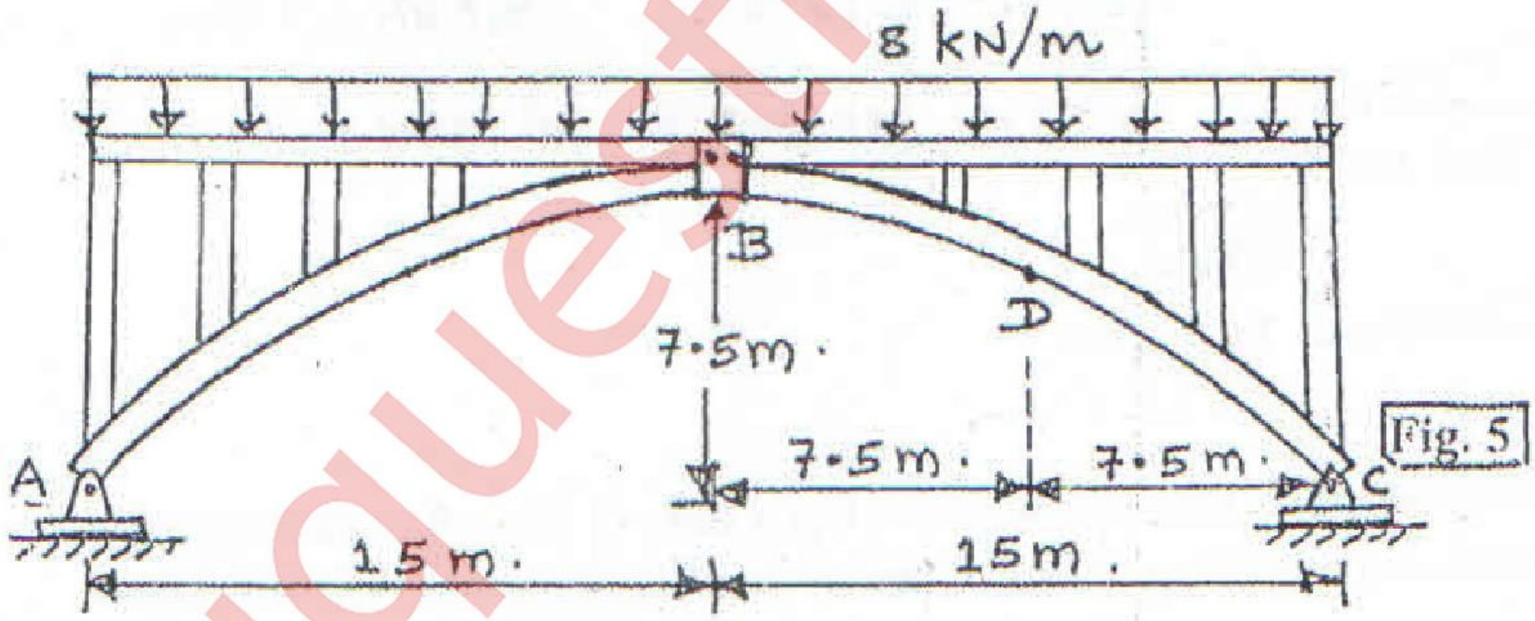

Fig. 5

B – Hinge

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(b) Determine the absolute maximum Bending Moment in a Simply Supported beam. (girder), when the three wheel loads pass from right to the left on the girder. Support (A) is a roller & support (B) is a hinge. Refer (Fig. 6). 8

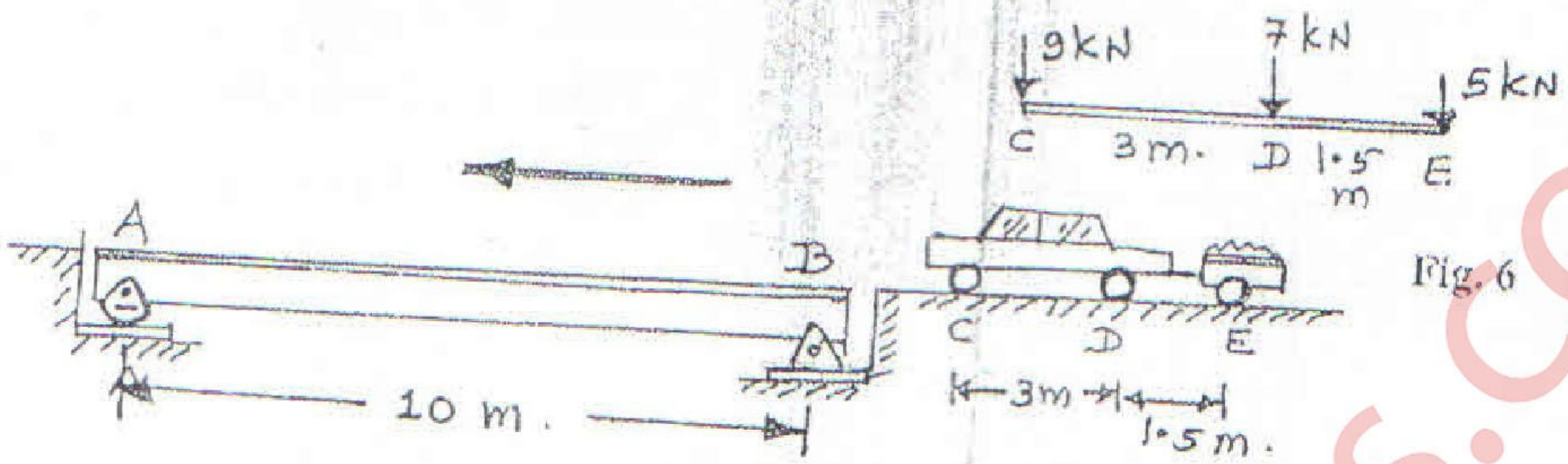

Fig. 6

(c) A hollow circular column has external diameter = 200 mm, internal dia = 160 mm, length = 4m. Load carried by column is 200 kN at an eccentricity of 25 mm. Both ends are fixed. Young's modulus = 94 X 10^3 MPa. Find the maximum bending moment. 4

4. (a) A suspension bridge of 250 m span has three hinged stiffening girder supported by a cable, with a central dip of 25 m, If 4 point loads of 150 kN each are placed at the distances of 20 m, 30 m, 40 m and 50 m from the left hand hinge, find the shear force and bending moment in the girder at 62.5 m from each end, Also find the maximum tension in the cable. 8

(b) Using Castigliano's theorem, determine vertical displacement of point C of beam (Fig. 7). Take E = 200 GPa, I = 150x10^6 mm^4. 8

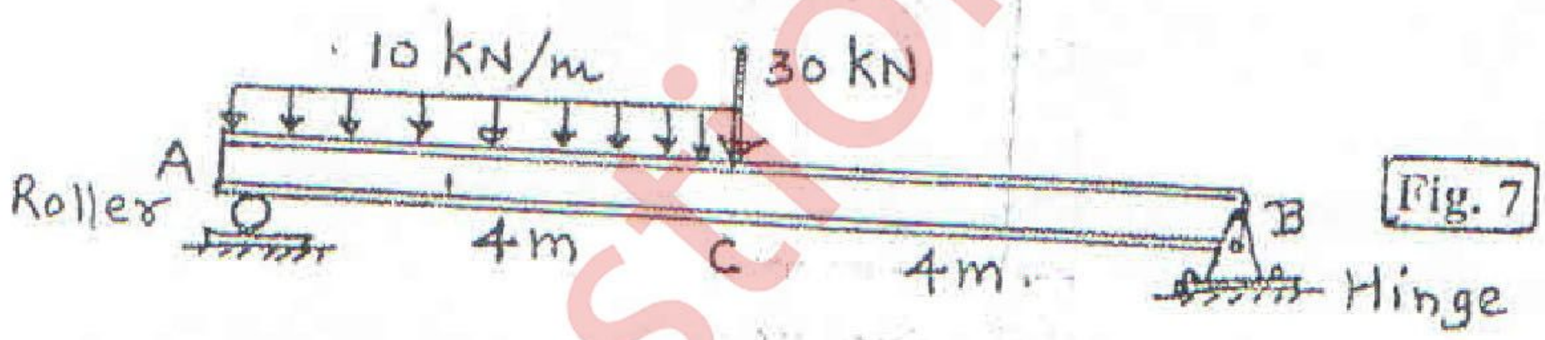

Fig. 7

(c) State the Maxwell's Reciprocal theorem & Betti's theorem. 4

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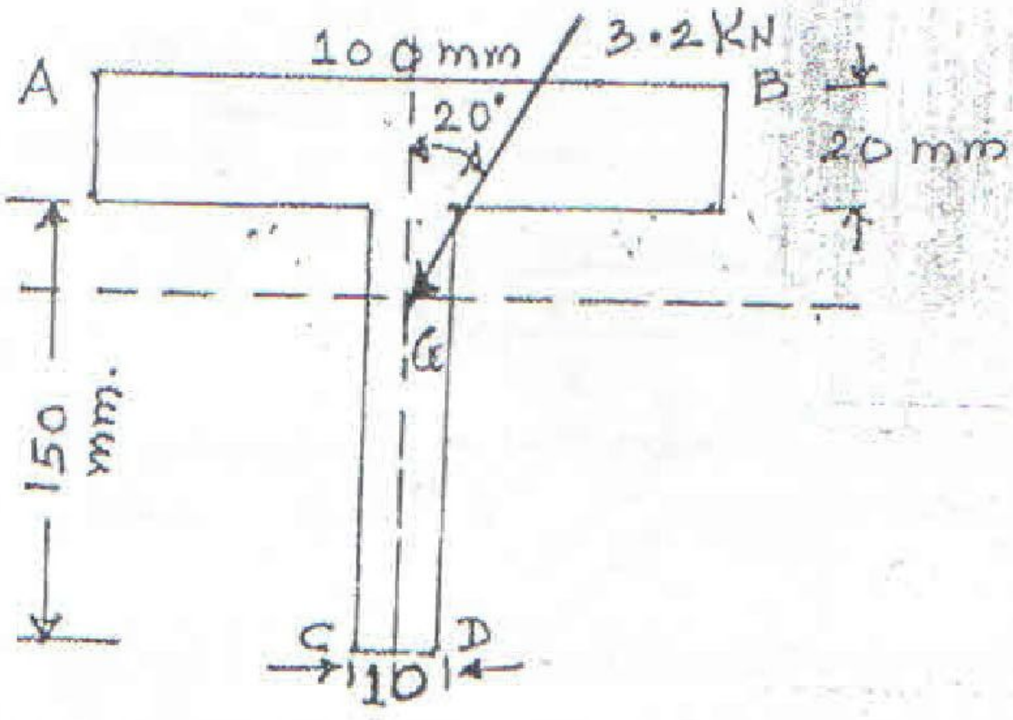
5. (a) A beam of T-section (Fig. 8) is 2.5 m long and is simply supported at the ends. It carries a load of 3.2 kN inclined at 20° to the vertical and passing through the centroid of the section, If E = 200 GN/m², calculate maximum tensile stress and maximum compressive stress. 8



Flange = (100 x 20) mm

Web = (10 x 150 mm)

Fig. 8

(b) Draw the Influence Line Diagrams for the forces in members A & B for the pin-jointed plane truss (Fig.9). 8

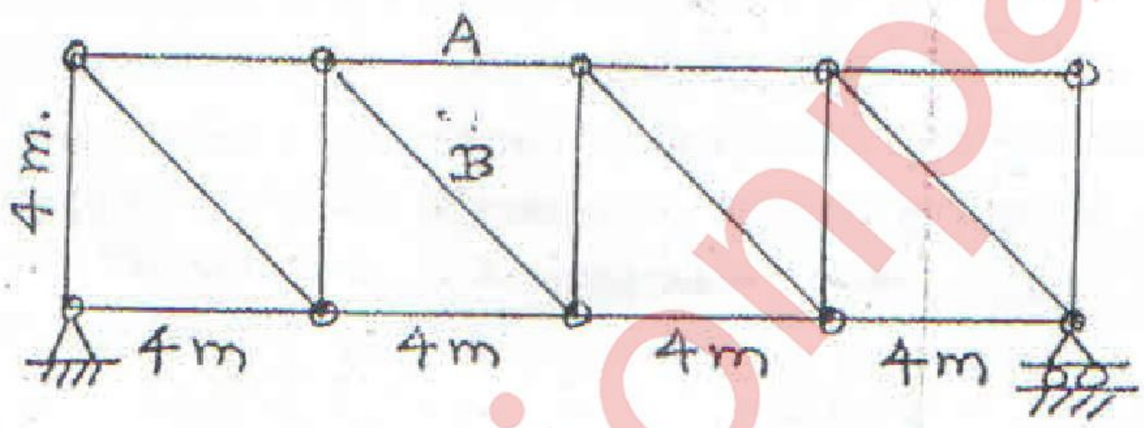


Fig. 9

(c) Using double integration method, determine the slope at the free end (B) of the cantilever beam (Fig. 10). 4

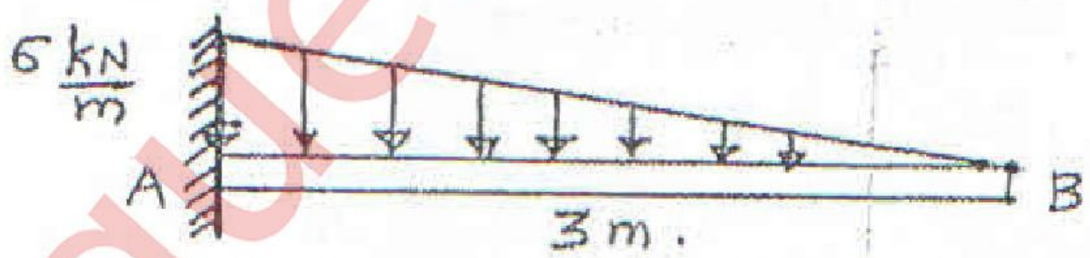


Fig. 10

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6. (a) Using Unit Load Method, find the vertical deflection of joint (C) of a pin-jointed plane truss (Fig. 11). Area of C/S of each member = 1100 mm² and E = 2.1X 10⁵ MPa. 7

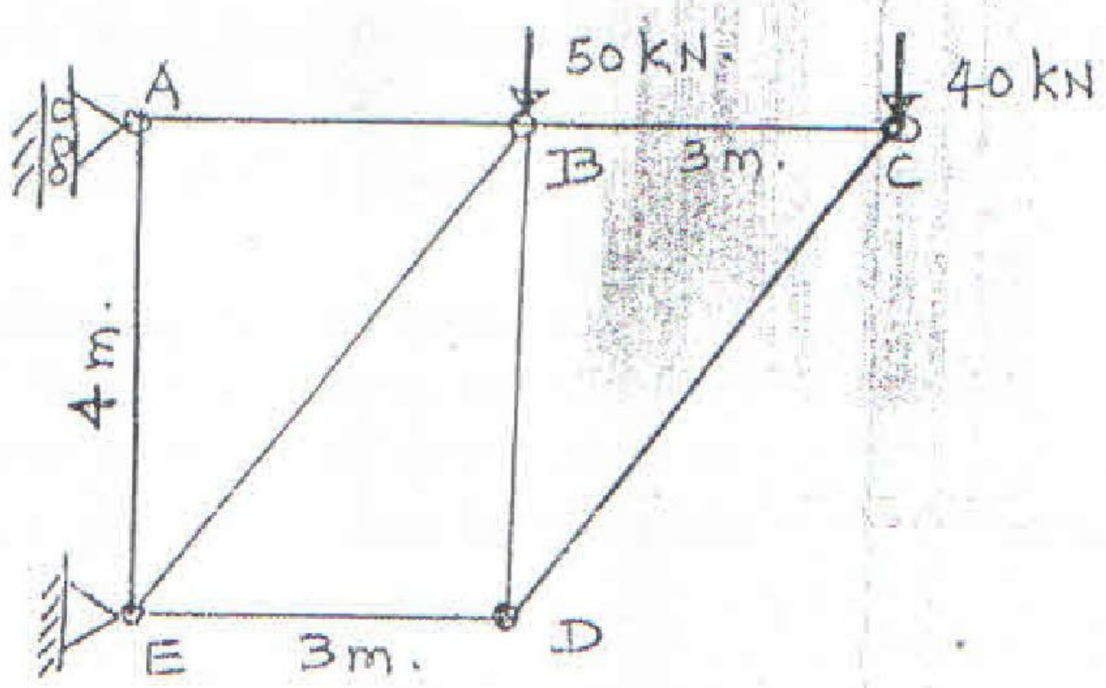


Fig. 11

(b) Using Castigliano's theorem, calculate the horizontal displacement of roller support (D) for the rigid jointed plane frame (Fig. 12). E = 2 X 10⁵ MPa & I = 5 X 10⁸ mm⁴. 7

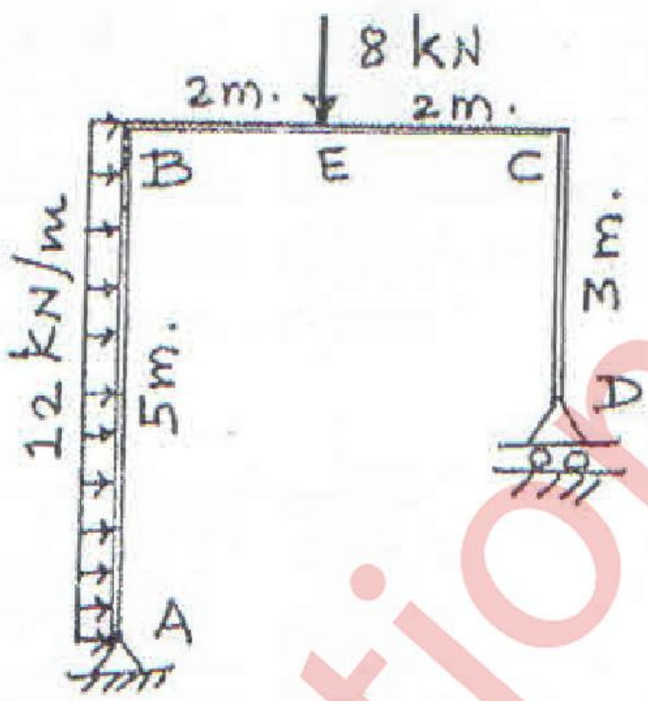
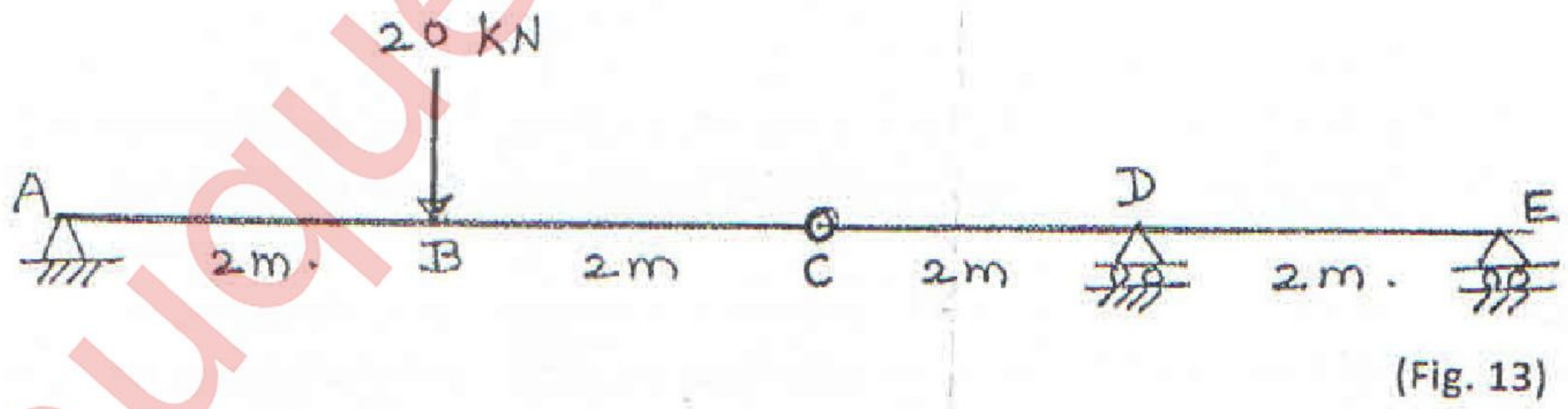


Fig. 12

(c) Find the slope at B for the beam (Fig. 13). Use Conjugate Beam Method. C is an internal hinge. Take E = 2 X 10⁵ MPa & I = 5 X 10⁷ mm⁴. 6



(Fig. 13)
