

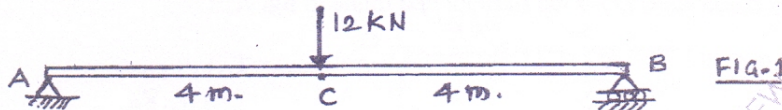
QP Code : 1391

(3 Hours)

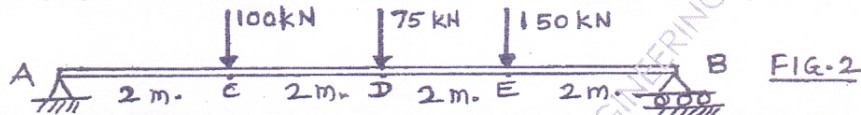
[Total Marks : 100]

**INSTRUCTIONS:** 1. Question No. 1 is **COMPULSORY** 2. Answer any **FOUR** from the remaining. 3. Each Full Question carries **EQUAL** marks. 4. **ASSUME** any suitable Data, if needed.

1. A) 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 10 kN/m throughout its length. Find the maximum & minimum tensions in the cable. (05 M)
- B) State & explain Maxwell's Reciprocal Theorem & Betti's Theorem. (05 M)
- C) Find the slope at A (fig. 1) by Conjugate Beam Method. EI = Constant. (05 M)

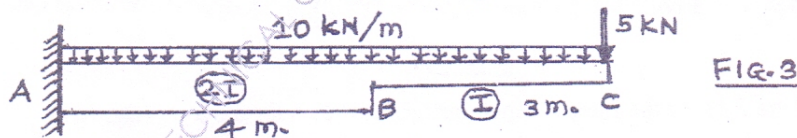


- D) Referring fig. 2, calculate the reaction at B using Influence Line Diagram. (05 M)

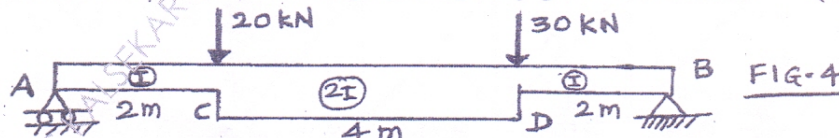


2. A) A three-hinged parabolic arch has a span of 20 m & a rise of 5 m. It carries a UDL of 25 kN/m over the left half of the span & a point load of 130 kN at 5 m from the right end. Find the Bending Moment, Normal Thrust & Radial Shear at a section 4 m from the left end. (12 M)
- B) A suspension cable of span 100 m & dip 10 m carries a UDL of 10 kN/m of horizontal span over the full span. Find the vertical & horizontal forces transmitted to the supporting pylons if the cable is passed over a smooth pulley. The anchor cable makes  $30^\circ$  to the horizontal at pylons. (08 M)

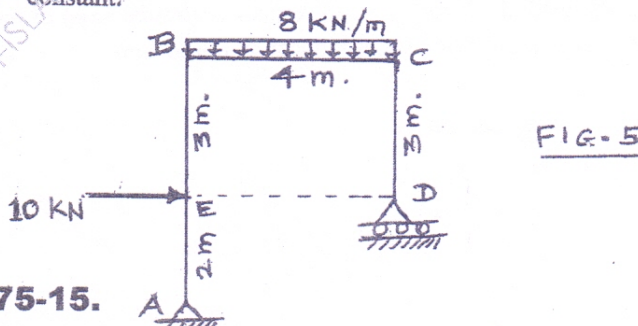
3. A) Find the slope & deflection at the free end (fig. 3), using Moment Area Method. (10 M)



- B) Find the slope at C & the deflection at D (fig. 4), using Conjugate Beam Method. (10 M)

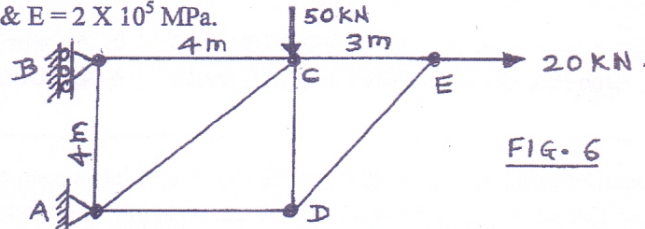


4. A) For the frame (fig. 5), find the horizontal movement of roller support D. Use Virtual Work Method. EI = constant. (10 M)



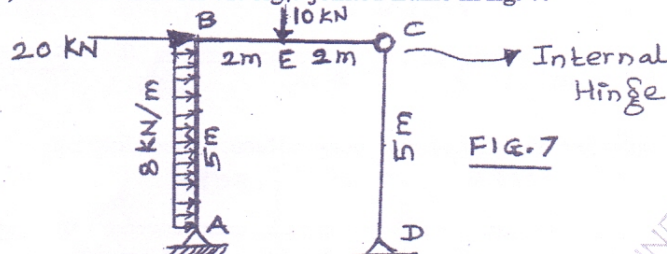
[TURN OVER]

- B) Find the vertical deflection of joint E for the truss (fig. 6), using Unit Load Method. Area of each member  $A = 1100 \text{ mm}^2$  &  $E = 2 \times 10^5 \text{ MPa}$ . (10 M)

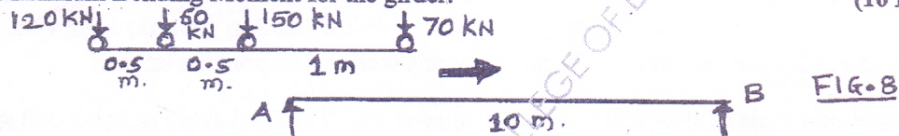


5. A) A hollow column of circular C/S has external diameter = 250 mm & internal diameter = 200 mm. It is 4.5 m long with both the ends hinged. It carries a longitudinal compressive load of 130 kN at an eccentricity of 20 mm. Find the maximum & minimum stresses produced in the column section. Take  $E = 1.1 \times 10^5 \text{ MPa}$ . (08 M)

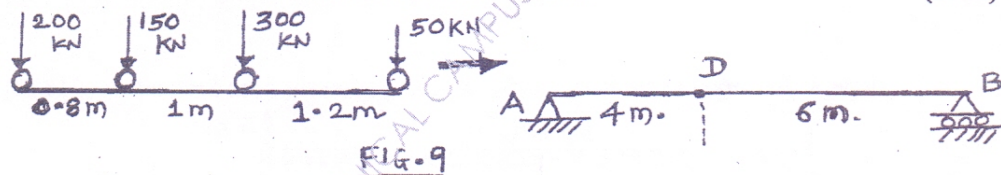
- B) Draw SFD, BMD & AFD for the rigid jointed frame in fig. 7. (12 M)



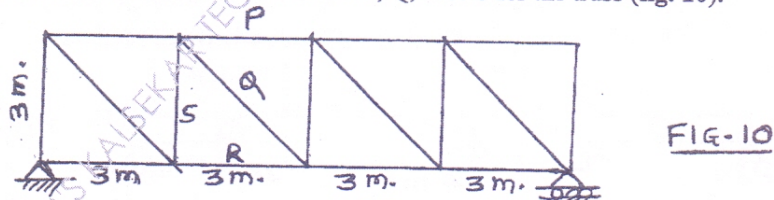
6. A) The load system (fig. 8) moves from the left to right on a girder of span 10 m. Find the Absolute Maximum Bending Moment for the girder. (10 M)



- B) The wheel loads (fig. 9) roll over along a beam of span 10 metres. Find the maximum bending moment which can occur at a section 4 m from the left end. (10 M)



7. A) Draw the ILD for the forces in members P, Q, R & S for the truss (fig. 10). (10 M)



- B) A beam of rectangular section, 90 mm wide & 130 mm deep is subjected to a BM of 13 kNm. The trace of plane of bending is inclined at  $45^\circ$  to y-y axis (vertical centroidal axis) of the section. Locate the neutral axis. Find the maximum bending stress induced in the section. (10 M)