

DEPARTMENT OF CIVIL ENGINEERING, IIT DELHI

MAJOR : CVL 756 ADVANCED STRUCTURAL ANALYSIS (2024-25)

Time allowed: 2 hours (6:00-8:00 pm)

Date: 22 Nov 2024

Venue: LH 416

Max marks : 50

NOTE: (a) All questions are compulsory. (b) Draw neat and clear sketches wherever required. (c) Assume suitable data if necessary. (d) Assume members as INEXTENSIBLE except for direct stiffness approach. (e) All answers must be supported by calculations/ justification. (f) This question paper has two printed pages (g) Assume any data you deem necessary. (h) **BEGIN ANSWER TO A QUESTION ON A FRESH PAGE**

Q1. Use matrix flexibility method to obtain rotation at point B of the structure shown in Fig. 2.

(08 marks)

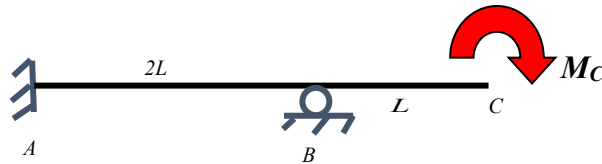
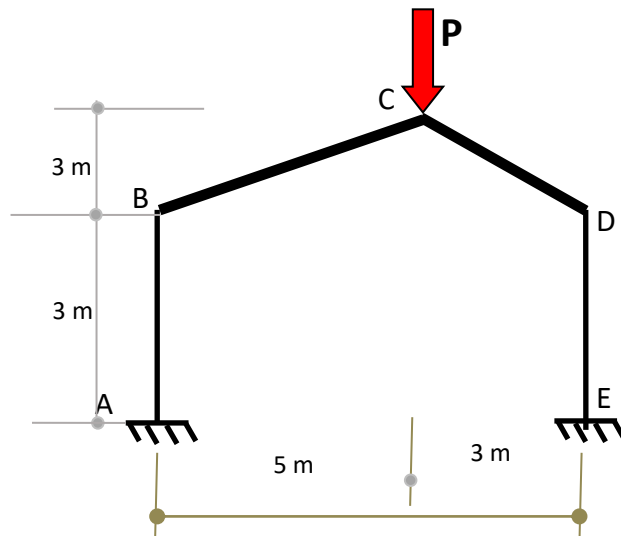


Fig. 1

Q2. The inclined portal frame shown in Fig. 2 has a plastic moment capacity of 300 kN-m for beams and 200 kN-m for columns. For this structure:

- Draw all possible failure mechanisms, including combined mechanisms, and also specify which mechanisms are not possible.
- Determine the failure load for the combined mechanism with the segment ABC remaining rigid.
- Check the satisfaction of the yield criteria at point D.



(5+10+5 = 20 marks)

Fig. 2

Q3. Derive the relation between bending moment and curvature for rectangular section. Find out the curvature just prior to full plastification of the section in terms of yield stress and Young's modulus. Draw theoretical and actual variation in curvature at collapse state for a simply supported beam under a point load

(6+4+2 = 12 marks)

Q4. Under what conditions is rigorous 3D analysis taking into account the rigid diaphragm action of floor slab is necessary rather than relying upon ordinary 3D analysis ignoring slab. Substantiate your answer with sound reasoning.

(5 marks)

Q5. Determine the half band width of $\mathbf{K}_{jj}$ for a 12 storeyed octagonal building with rigid floor slabs at all levels, all floor beams along the boundary of the octagon only.

(5 marks)