

DEPARTMENT OF CIVIL ENGINEERING, IIT DELHI

MAJOR :CEL717 ADVANCED STRUCTURAL ANALYSIS (2014-15)

Time allowed: 2 hours

Date: 27 Nov 2014

Venue: V 216

Max marks : 40

NOTE: (a) All questions are compulsory. (b) Draw neat and clear sketches wherever required.
(c) Assume suitable data if necessary. (d) Assume members as extensible unless otherwise stated.
(e) All answers must be supported by calculations/ justification to secure assigned marks.

Q1. For the frame structure shown in **Fig. 1**, use the matrix flexibility approach to calculate horizontal deflection at B, the point of application of the load P. **Assume all members have equal EI values.**

(6 marks)

Q2. Analyze the frame shown in **Fig. 2** using the plastic analysis approach. The plastic moment capacities of various members are indicated in the figure. Check the critical failure mechanism for satisfaction of the yield criterion.

(10 marks)

Q3. Derive an expression for the maximum slope of a thin plate as a function of vertical displacement. State the assumptions clearly. Determine the bending moments in x and y directions for a thin plate of 5mm thickness at a point where the curvatures in x and y directions are both equal to 0.0002. Assume material parameters of structural steel

(6+4 = 10 marks)

Q4. What additional steps are needed in the normal 3D matrix stiffness approach to take into account the action of floor slabs?

(5 marks)

Q5. How will you tackle the case of internal hinge for the structure shown in Fig. 3 in the 2D matrix stiffness approach? Present mathematical formulations wherever needed to substantiate your answer.

(5 marks)

Q6. Derive K_{33} of a deep beam taking into consideration the shear deformation effect.

(4 marks)

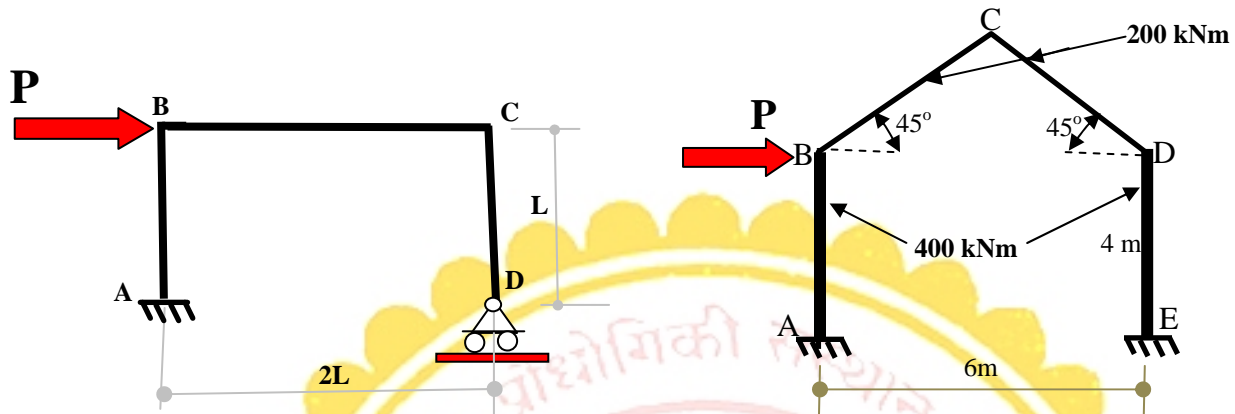


Fig. 1

Fig. 2

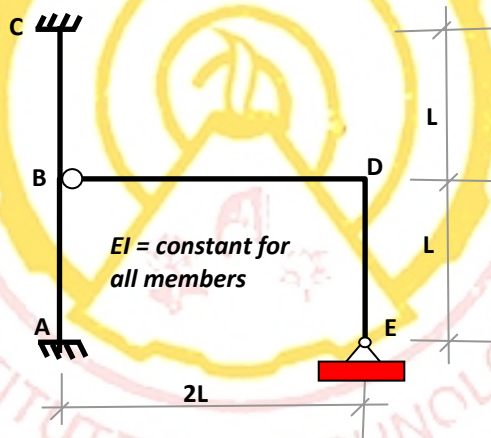


Fig. 3