

DEPARTMENT OF CIVIL ENGINEERING, IIT DELHI

MAJOR : CVL 756 ADVANCED STRUCTURAL ANALYSIS (2021-22)

Time allowed: 90 mins

Date: 15 Nov 2021

Venue: Online

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 INEXTENSIBLE unless otherwise stated. (e) All answers must be supported by calculations/ justification to secure assigned marks. (f) This question paper has two printed pages (g) BEGIN ANSWER TO A QUESTION ON A FRESH PAGE

Q1. How are the stresses σ_x and σ_y related to vertical displacement in a thin plate structure? Derive an expression for moment M_x in terms of the vertical displacement.
(3+5=8 marks)

Q2. The inclined frame structure shown in Fig. 1 has a plastic moment capacity of 500 kNm for all members. For this structure:

- (a) Draw all possible mechanisms.
- (b) Determine the failure load for the combined mechanism
- (c) Perform yield check at joint B and comment on the result.

(3+8+4 = 15 marks)

Q3. The structure shown in Fig. 2 has rigid slabs at two levels as shown. All joint (and DOF) numbering proceeds from top to bottom. For this structure:

- (a) Determine the sizes of the matrices K_{pp} and K_{JJ} and K_{FF}
- (b) Form the association matrix of the member connected between joints 7 and 8
- (c) What would be the sizes of K_{pp} and K_{xx} if a hinge is introduced at support 13.

(3+5+3=11 marks)

Q4. Derive F_{33} of a non-prismatic member which has its moment of inertia following a profile defined by: $I = I_o \sin\left(\frac{\pi x}{L}\right)$

(06 marks)

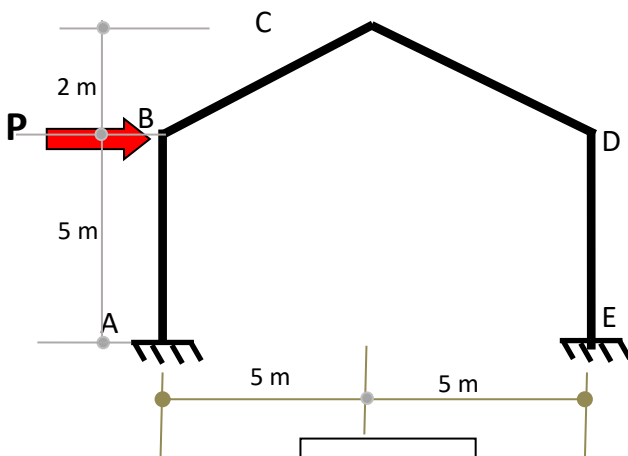


Fig. 1

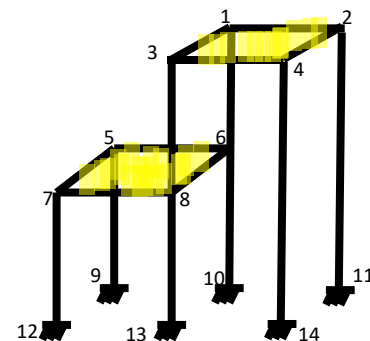


Fig. 2