DEPARTMENT OF CIVIL ENGINEERING, IIT DELHI

MAJOR : CVL 756 ADVANCED STRUCTURAL ANALYSIS (2017-18)

Time allowed: 2 hours   **Date:** 23 Nov 2017
Venue: LH 318   **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.
         (f) This question paper has two printed pages

Q1. (a) Define curvature of a thin plate. What do you mean by positive and negative curvatures?

(b) From first principles, derive an expression for **twist** of a thin plate in a general direction "*nt*". From this expression, how can the direction of the principal curvature be ascertained?

(2+5 = 7 marks)

Q2. For the frame structure shown in Figure 1, obtain the ultimate failure load for the mechanism in which plastic hinges develop at all joints except "B". Check for the satisfaction of the yield criteria.
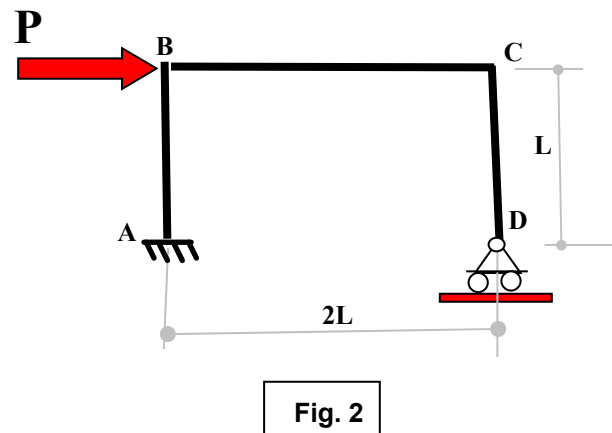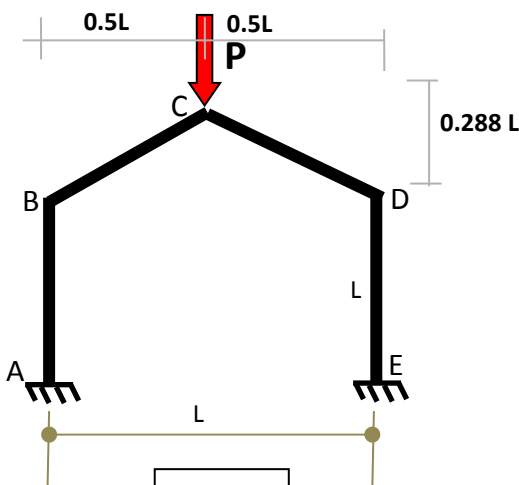
(10+4 = 14 marks)

Q3. Obtain the horizontal displacement of the frame structure shown in Fig. 2 using the matrix force method. Assume all members have same EI values.

(6 marks)

Q4. In direct stiffness method, explain what additional steps are necessary accommodate a UDL (as compared to a joint loads) so as to get correct output.

(4 marks)

Fig. 1

Fig. 2

Q5. Mention any three scenarios where the method of substructures would be expedient in the analysis of frame structure.

(3 marks)

Q6. Derive shape factor for the triangular section shown in Fig. 3

(3 marks)

Q7. Conceptually explain how would you accommodate the presence of spring for the frame structure shown in Fig. 4.
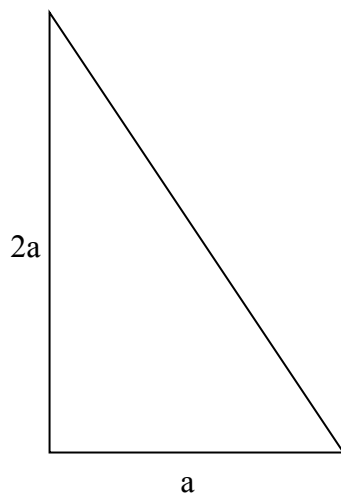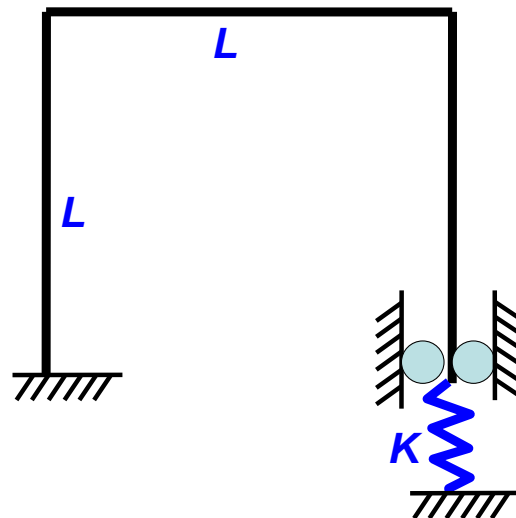
(3 marks)

Fig. 3

Fig. 4