# DEPARTMENT OF CIVIL ENGINEERING, IIT DELHI

## MINOR I :CEL717 ADVANCED STRUCTURAL ANALYSIS (2014-15)

**Time allowed:** 1hour **Date:** 28 August 2014
**Venue:** IV LT 1 **Max marks** : **20**

**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.**

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**Q1**. Explain how the direct stiffness approach uses finite element formulation?

**(3 marks)**

**Q2.** The structure, whose plan is shown in Fig. 1, is a 3D **five storeyed frame** which is to be analyzed using the direct stiffness approach with the aid of a **computer program**. It has a rigid slab at each floor level

(a) Will simple plane frame analysis be able to provide realistic solution for lateral load analysis if the lateral load does is eccentric? Why?
(b) Can slab effect be ignored if the lateral load does not act eccentrically? Give reasons for your answer.
(c) For 3D analysis with slab effect, how should the joints be numbered (horizontally or vertically) to attain smaller band width? Justify your answer.
(d) Determine the sizes of $K_{JJ}$ and $K_{FF}$.
(e) Determine half band width of $K_{JJ}$.

**(2+2+3+2+2 = 11 marks)**

**Q3.** Let the structure shown in Fig. 2 be analyzed using the direct stiffness approach using a computer program.

(a) How would you number the joints of the structure?
(b) Generate the load vector of the structure.
(c) Which elements of the member stiffness matrices (in global coordinates) of AB, BC and CD contribute towards $K_{TS}$ (i,j), where
i= DOF corresponding to horizontal displacement at C
j= DOF corresponding to vertical displacement at C

**(1+2+3 = 6 marks)**

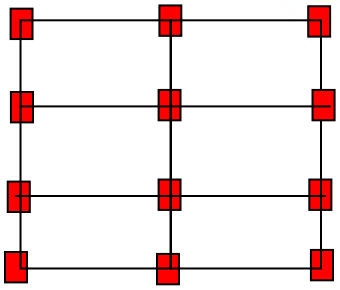

Fig. 1

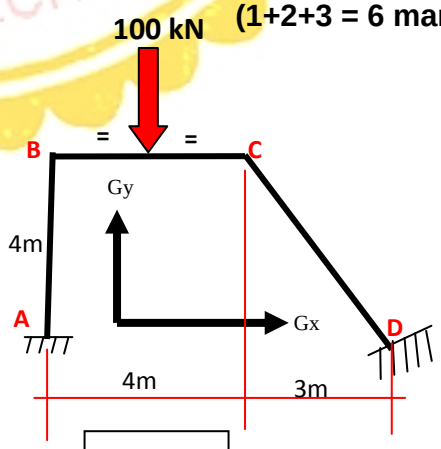


FIG. 2