

DEPARTMENT OF CIVIL ENGINEERING
IIT DELHI



CEL331 STRUCTURAL ANALYSIS II (2012-13)
PROGRAMMING ASSIGNMENT (B)

(To be done in groups of 3)

(Available online at: <http://web.iitd.ac.in/~sbhalla/cel331.htm>)

Develop a computer program (in C++, FORTRAN, MATLAB or any standard language) to analyse a plane frame of the type shown in the figure below. The frame has 'm' number of bays and 'n' number of storeys and is subjected to **horizontal loads only**. The program should interactively obtain following data from the user:

- (i) Number of bays (m) and storeys (n).
- (ii) Bay length and storey height (assumed constants).
- (iii) Horizontal load at each floor level (may differ from one floor to other).
- (iv) Sectional properties (A and I) and Young's modulus (E) of beams (assumed same for all beams)
- (v) Sectional properties (A and I) and Young's modulus (E) of columns (assumed same for all columns).

The program should automatically generate joint and member numbers and assemble the total structural stiffness matrix. Those programming in MATLAB should not use existing function for matrix inversion, but should develop their own. Final output should be in the following form, preferably in the form of an output file:

- (i) All nodal displacements.
- (ii) All member end forces/ displacements.
- (iii) All reactions.

Test your program on a test frame consisting of $m = 5$ and $n = 3$. Check for the equilibrium of external forces and reactions. Assume columns of 300x300mm and beams 300x600mm cross section. A storey height of 4m may be considered. Assume M 20 concrete.

SUBMISSION: One report per group should be submitted. It should be typed and should include brief theory, basic steps executed by the program (in the form of a flow chart) and results of the 'test' as indicated above. The report should be less than 8 pages under all circumstances. Along with report, each group should submit the *source code* as well as *executable file* in a floppy or CD. Last date for submission is **01 NOVEMBER 2012**. **Negative marking will be imposed on groups submitting late.**

