



CVL756 ADVANCED STRUCTURAL ANALYSIS (2023-24)
PROGRAMMING ASSIGNMENT (A)

(To be done in groups of 3)

(Available online at: <http://web.iitd.ac.in/~sbhalla/cvl756.html>)

Write a computer program (in C++, FORTRAN, MATLAB or any standard language) to analyse a **3D single storey space frame with equilateral TRIANGULAR shape bound by a rigid slab**. The frame is subjected to **lateral loads in the x direction**. The program should interactively obtain following data from the user:

- (i) Coordinates of the first floor joints (floor height shall be common).
- (ii) Horizontal load at each node.
- (iii) Sectional properties (A and I) and Young's modulus (E) of beams (assumed same for all beams) or alternatively the member sizes.
- (iv) Sectional properties (A and I) and Young's modulus (E) of columns (assumed same for all columns) or alternatively the member sizes.

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 write 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/ moments.
- (iii) All reactions.

Test your program on a 3D frame with appropriate dimensions and of members with appropriate cross sections. Check for the equilibrium of external forces and reactions. Compare results with STAAD or any other standard analysis software.

SUBMISSION: One report per group should be submitted. It should be typed and should include most 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 5 pages under all circumstances. Along with report, each group should submit the **source code** as a single file in Moodle. Last date for submission is **06 Nov 2023**. Negative marking will be imposed on groups submitting late. **Each group will make a presentation of their program, which shall be arranged in the month of November.**



CVL756 ADVANCED STRUCTURAL ANALYSIS (2023-24)
PROGRAMMING ASSIGNMENT (B)

(To be done in groups of 3)

(Available online at: <http://web.iitd.ac.in/~sbhalla/cvl756.html>)

Write a computer program (in C++, FORTRAN, MATLAB or any standard language) to analyse a **3D single storey space frame with square shape bound by a rigid slab**. The frame is subjected to **lateral loads in the x direction**. The program should interactively obtain following data from the user:

- (i) Dimensions and height of the first floor.
- (ii) Horizontal load at each node.
- (iii) Sectional properties (A and I) and Young's modulus (E) of beams (assumed same for all beams) or alternatively the member sizes.
- (iv) Sectional properties (A and I) and Young's modulus (E) of columns (assumed same for all columns) or alternatively the member sizes.

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 write 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/ moments.
- (iii) All reactions.

Test your program on a 3D frame with appropriate dimensions and of members with appropriate cross sections. Check for the equilibrium of external forces and reactions. Compare results with STAAD or any other standard analysis software.

SUBMISSION: One report per group should be submitted. It should be typed and should include most 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 5 pages under all circumstances. Along with report, each group should submit the **source code** as a single file in Moodle. Last date for submission is **06 Nov 2023**. Negative marking will be imposed on groups submitting late. **Each group will make a presentation of their program, which shall be arranged in the month of November.**



CVL756 ADVANCED STRUCTURAL ANALYSIS (202-22)
PROGRAMMING ASSIGNMENT (C)

(To be done in groups of 3)

(Available online at: <http://web.iitd.ac.in/~sbhalla/cvl756.html>)

Write a computer program (in C++, FORTRAN, MATLAB or any standard language) to analyse a **3D single storey space frame with PENTAGONAL shape (all sides equal) bound by a rigid slab**. The frame is subjected to **lateral loads in the x direction**. The program should interactively obtain following data from the user:

- (i) Dimensions and height of first floor (pentagon shape).
- (ii) Horizontal load at each node.
- (iii) Sectional properties (A and I) and Young's modulus (E) of beams (assumed same for all beams) or alternatively the member sizes.
- (iv) Sectional properties (A and I) and Young's modulus (E) of columns (assumed same for all columns) or alternatively the member sizes.

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 write 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/ moments.
- (iii) All reactions.

Test your program on a 3D frame with appropriate dimensions and of members with appropriate cross sections. Check for the equilibrium of external forces and reactions. Compare results with STAAD or any other standard analysis software.

SUBMISSION: One report per group should be submitted. It should be typed and should include most 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 5 pages under all circumstances. Along with report, each group should submit the **source code** as a single file in Moodle. Last date for submission is **06 Nov 2023**. Negative marking will be imposed on groups submitting late. **Each group will make a presentation of their program, which shall be arranged in the month of November.**



CVL756 ADVANCED STRUCTURAL ANALYSIS (2022-23)
PROGRAMMING ASSIGNMENT (D)

(To be done in groups of 3)

(Available online at: <http://web.iitd.ac.in/~sbhalla/cvl756.html>)

Write a computer program (in C++, FORTRAN, MATLAB or any standard language) to analyse a **3D single storey space frame with HEXAGONAL shape (all sides equal) bound by a rigid slab**. The frame is subjected to **lateral loads in the x direction**. The program should interactively obtain following data from the user:

- (v) Dimensions and height of first floor (hexagon shape).
- (vi) Horizontal load at each node.
- (vii) Sectional properties (A and I) and Young's modulus (E) of beams (assumed same for all beams) or alternatively the member sizes.
- (viii) Sectional properties (A and I) and Young's modulus (E) of columns (assumed same for all columns) or alternatively the member sizes.

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 write their own.** Final output should be in the following form, preferably in the form of an output file:

- (iv) All nodal displacements.
- (v) All member end forces/ moments.
- (vi) All reactions.

Test your program on a 3D frame with appropriate dimensions and of members with appropriate cross sections. Check for the equilibrium of external forces and reactions. Compare results with STAAD or any other standard analysis software.

SUBMISSION: One report per group should be submitted. It should be typed and should include most 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 5 pages under all circumstances. Along with report, each group should submit the **source code** as a single file in Moodle. Last date for submission is **06 Nov 2023**. Negative marking will be imposed on groups submitting late. **Each group will make a presentation of their program, which shall be arranged in the month of November.**



CVL756 ADVANCED STRUCTURAL ANALYSIS (2021-22)
PROGRAMMING ASSIGNMENT (E)

(To be done in groups of 3)

(Available online at: <http://web.iitd.ac.in/~sbhalla/cvl756.html>)

Write a computer program (in C++, FORTRAN, MATLAB or any standard language) to analyse a **3D single storey space frame with L shape (total 8 equidistant columns) bound by a rigid slab**. The frame is subjected to **lateral loads in the x direction**. The program should interactively obtain following data from the user:

- (i) Dimensions and height of first floor (L shape).
- (ii) Horizontal load at each node.
- (iii) Sectional properties (A and I) and Young's modulus (E) of beams (assumed same for all beams) or alternatively the member sizes.
- (iv) Sectional properties (A and I) and Young's modulus (E) of columns (assumed same for all columns) or alternatively the member sizes.

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 write 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/ moments.
- (iii) All reactions.

Test your program on a 3D frame with appropriate dimensions and of members with appropriate cross sections. Check for the equilibrium of external forces and reactions. Compare results with STAAD or any other standard analysis software.

SUBMISSION: One report per group should be submitted. It should be typed and should include most 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 5 pages under all circumstances. Along with report, each group should submit the **source code** as a single file in Moodle. Last date for submission is **06 Nov 2023**. Negative marking will be imposed on groups submitting late. **Each group will make a presentation of their program, which shall be arranged in the month of November.**



CVL756 ADVANCED STRUCTURAL ANALYSIS (2022-23)
PROGRAMMING ASSIGNMENT (F)

(To be done in groups of 3)

(Available online at: <http://web.iitd.ac.in/~sbhalla/cvl756.html>)

Write a computer program (in C++, FORTRAN, MATLAB or any standard language) to analyse a **3D single storey space frame with trapezoid shape bound by a rigid slab**. The frame is subjected to **lateral loads in the x direction**. The program should interactively obtain following data from the user:

- (i) Dimensions and height of first floor (trapezoid shape), either in form of coordinates or member lengths.
- (ii) Horizontal load at each node.
- (iii) Sectional properties (A and I) and Young's modulus (E) of beams (assumed same for all beams) or alternatively the member sizes.
- (iv) Sectional properties (A and I) and Young's modulus (E) of columns (assumed same for all columns) or alternatively the member sizes.

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 write 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/ moments.
- (iii) All reactions.

Test your program on a 3D frame with appropriate dimensions and of members with appropriate cross sections. Check for the equilibrium of external forces and reactions. Compare results with STAAD or any other standard analysis software.

SUBMISSION: One report per group should be submitted. It should be typed and should include most 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 5 pages under all circumstances. Along with report, each group should submit the **source code** as a single file in Moodle. Last date for submission is **06 Nov 2023**. Negative marking will be imposed on groups submitting late. **Each group will make a presentation of their program, which shall be arranged in the month of November.**

PROGRAMMING ASSIGNMENT (G)

Same details as A, except that two storey and no floor slab present

PROGRAMMING ASSIGNMENT (H)

Same details as B, except that two storey and no floor slab present

PROGRAMMING ASSIGNMENT (I)

Same details as C, except that two storey and no floor slab present

PROGRAMMING ASSIGNMENT (J)

Same details as D, except that two storey and no floor slab present

PROGRAMMING ASSIGNMENT (K)

Same details as E, except that two storey and no floor slab present

PROGRAMMING ASSIGNMENT (L)

Same details as F, except that two storey and no floor slab present