New York University Tandon School of Engineering
Department of Civil and Urban Engineering Department

SPRING 2021
CE-UY 3133 - STRUCTURAL ANALYSIS

Instructor: Prof. Luis Ceferino. E-mail: ceferino@nyu.edu
Course Assistant: Salman Khan Mohammed. E-mail: skm543@nyu.edu

Tu-Th 08:00 AM – 9:20 AM (ET)

Course Pre-requisite: CE-UY 2143 – Analysis of Determinate Structures

Course Description:

This course offers in-depth coverage of structural analysis techniques. The class will start with a review of statically determinate structures, including principles of equilibrium and energy, the internal force assessment, and influence line calculation. The class then will cover the analysis of statically indeterminate structures using the Force Method and the Displacement Method. The course will then largely focus on the Stiffness Method, a Displacement Method used in most modern structural analysis practice and included in most professional software packages. The course will include programming exercises to solve for indeterminate structures that can be implemented in Excel spreadsheets or using programming languages such as Python or Matlab.

Course Objectives:

1- To provide students with a clear and thorough understanding of structural analysis theory and its application to trusses, beams, and frames.
2- To develop the ability to represent a structure with a mathematical model and analyze its acting forces and deflections.
3- To provide students with sophisticated and simplified structural analysis tools to build practical problem-solving skills required for professional careers.

Textbook:

Required book:
- Structural Analysis by Hibbeler, R.C, Pearson Prentice Hall, Tenth Edition

Suggested book:
- Matrix Structural Analysis by W. McGuire, R. Gallagher, and R. Ziemian, Second Edition (Online version)

Software:

- MASTAN2. Free software for Structural Analysis (http://www.mastan2.com/)

- Microsoft Excel processing skills required. Computer coding skills in Python or Matlab are not required, but they will make you take full advantage of the class.

Grading:

Class Participation	5%
Homework	30%
Midterm Exam I	20%
Midterm Exam II	20%.
Final Exam	25%

Office Hours:

Prof. Luis Ceferino: Tu-Th 9:20 AM – 10:30 AM
Salman Khan Mohammed: TBD

LECTURE TOPICS:

Week 1

Th Jan 28th: Welcome to CE-UY 3133.

Week 2

Tu Feb 2nd Types and Classification of Structures.

Th Feb 4th: Structural Stability and Determinacy. Assigment #1 out.

Week 3

Tu Feb 9th: Analysis of Determinate Structures – Trusses and Beams.

Th Feb 11th: Analysis of Determinate Structures – Frames. Assigment #1 due. Assigment #2 out.

Week 4

Tu Feb 16th: Influence Lines. Principles. Application to Beams

Th Feb 18th: No Classes. Legislative day

Week 5

Tu Feb 23th: Deflections

Th Feb 25th: Work and Energy for Deflection Estimation. Principle of Virtual Forces. Assigment #2 due. Assigment #3 out.

Week 6

Tu Mar 2nd: Force Method. Applications to Trusses and Beams.

Th Mar 4th: Force Method. Applications to Frames.

Week 7

Tu Mar 9th: Displacement Method: Slope-Deflection. Principles. Assigment #3 due. Assigment #4 out.

Th Mar 11th: Midterm I

Week 8

Tu Mar 16th: Displacement Method: Slope-Deflection. Application to Beams and Frames.

Th Mar 18th: Displacement Method: Slope-Deflection. Sidesway.

Week 9

Tu Mar 23th: Approximate Analysis of Indeterminate Structures - Trusses. Assigment #4 due. Assigment #5 out.

Th Mar 25th: Approximate Analysis of Indeterminate Structures - Frames

Week 10:

Tu Mar 30th: Stiffness Method: Principles. Assigment #5 due. Assigment #6 out.

Th Apr 1st: Stiffness Method: Truss Analysis

Week 11:

Tu Apr 6th: Midterm II

Th Apr 8th: Stiffness Method: Frame Analysis I

Week 12:

Tu Apr 13th: Stiffness Method: Frame Analysis II

Th Apr 15th: Stiffness Method: 3D Transformations. Assigment #6 due. Assigment #7 out.

Week 13

Tu Apr 20th: Stiffness Method: Distributed Member Loads, Temperature Loads, and Self-Straining Loads

Th Apr 22nd: Stiffness Method: Solution of Linnear System of Equations and Numerical Accuracy

Week 14:

Tu Apr 27th: Principle of Virtual Displacements for Stiffness Matrix Estimation. Class Review. Assigment #7 due. Assigment #8 out.

Th Apr 29th: Structural Analysis Software tutorial

Week 15:

Tu May 4th: Guest speaker

Th May 6th: Assignment #8 due. No Classes. Legislative Day

Week 16: Reading days and Final Exam Week

Late policy

Each of the assignments is due at the **start of class** on the dates specified in the syllabus. The assignment can be submitted in a hard copy or electronically by **e-mail to both the instructor and grader** with e-mail subject with the following format "Homework 1 Submission – Last Name". All assignments are due at 8:00 AM Eastern Time (ET) sharp on the dates indicated in each assignment. Any partial or full submission that comes after 8:00 AM will give the entire homework a **late** status.

We understand that during the semester work can pile up, and you might need extra time. Thus, we will give every student four free "late days." Each late day is a 24-hour period (e.g., from Monday 8:00 AM to Tuesday 8:00 AM is one late day). You can use your late days to turn in homeworks after the regular deadline without penalty. If you use all your late days, then you can use up to five additional late days, but you will receive a penalty of 10% of your grade per late day. **Homeworks submitted later than five days following the due date will not be graded.** Note that the last day to submit homework #7 will be Monday, May 10th at 8:00 AM.

These free late days are extensions you have been granted ahead of time. Please use them when you might have otherwise tried to ask for an extension. **Getting an extension beyond the four free late days will generally not be granted**. In exceptional circumstances (primarily medical problems or other emergencies), extensions may be granted beyond the late days. All extension requests must be directed to **both the grader and the instructor** no later than 24 hours before the program is due. Only the grader will be able to approve extensions.

Diversity Statement

The NYU Tandon School values an inclusive and equitable environment for all our students. I hope to foster a sense of community in this class and consider it a place where individuals of all backgrounds, beliefs, ethnicities, national origins, gender identities, sexual orientations, religious and political affiliations, and abilities will be treated with respect. It is my intent that all students' learning needs be addressed both in and out of class and that the diversity that students bring to this class be viewed as a resource, strength, and benefit. If this standard is not being upheld, please feel free to speak with me.

ABET Competencies:

1. Ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics

Moses Center Statement of Disability

If you are student with a disability who is requesting accommodations, please contact New York University's Moses Center for Students with Disabilities (CSD) at 212-998-4980 or mosescsd@nyu.edu. You must be registered with CSD to receive accommodations. Information about the Moses Center can be found at www.nyu.edu/csd. The Moses Center is located at 726 Broadway on the 2nd floor.

NYU School of Engineering Policies and Procedures on Academic Misconduct

A. Introduction: The School of Engineering encourages academic excellence in an environment that promotes honesty, integrity, and fairness, and students at the School of Engineering are expected to exhibit those qualities in their academic work. It is through the process of submitting their own work and receiving honest feedback on that work that students may progress academically. Any act of academic dishonesty is seen as an attack upon the School and will not be tolerated. Furthermore, those who breach the School's rules on academic integrity will be sanctioned under this Policy. Students are responsible for familiarizing themselves with the School's Policy on Academic Misconduct.

B. Definition: Academic dishonesty may include misrepresentation, deception, dishonesty, or any act of falsification committed by a student to influence a grade or other academic evaluation. Academic

dishonesty also includes intentionally damaging the academic work of others or assisting other students in acts of dishonesty. Common examples of academically dishonest behavior include, but are not limited to, the following:

1. Cheating: intentionally using or attempting to use unauthorized notes, books, electronic media, or electronic communications in an exam; talking with fellow students or looking at another person's work during an exam; submitting work prepared in advance for an in-class examination; having someone take an exam for you or taking an exam for someone else; violating other rules governing the administration of examinations.

2. Fabrication: including but not limited to, falsifying experimental data and/or citations.

3. Plagiarism: intentionally or knowingly representing the words or ideas of another as one's own in any academic exercise; failure to attribute direct quotations, paraphrases, or borrowed facts or information.
4. Unauthorized collaboration: working together on work that was meant to be done individually.

5. Duplicating work: presenting for grading the same work for more than one project or in more than one class, unless express and prior permission has been received from the course instructor(s) or research adviser involved.

6. Forgery: altering any academic document, including, but not limited to, academic records, admissions materials, or medical excuses.