New Jersey Institute of Technology

Digital Commons @ NJIT

Civil and Environmental Engineering Syllabi

NJIT Syllabi

Spring 2022

CE 332-002: Structural Analysis

Mohamad Saadeghvaziri

Follow this and additional works at: https://digitalcommons.njit.edu/ce-syllabi

CE 332 – Structural Analysis	Spring 2022
Texts:	Hibbeler, Russell C., <u>Structural Analysis,</u> 10th Edition, Prentice Hall ISBN: 978033942842
Instructor:	Dr. M. Ala Saadeghvaziri, Room 260 Colton Hall, Tel: 973-596-5813, ala@njit.edu ; Office hours: Mondays 1 – 2:30PM, Wednesdays 4 – 5:30PM, other times by appointment. Please do not be shy and schedule a meeting to see me when you need help. TA (Noah Thibodeaux) Office Hours: Tuesdays 1 – 2:30PM, and Fridays 11:00AM – 12:30PM; nt82@njit.edu

Prerequisite: MECH 237 with a grade of C or better. A working knowledge of free body diagrams, equilibrium conditions for force systems and moments. The primary objective is an understanding of the various methods of analyzing determinate and indeterminate beams, frames, and trusses encountered in practice.

"Academic Integrity is the cornerstone of higher education and is central to the ideals of this course and the university. Cheating is strictly prohibited and devalues the degree that you are working on. As a member of the NJIT community, it is your responsibility to protect your educational investment by knowing and following the academic code of integrity policy that is found at: http://www5.njit.edu/policies/sites/policies/files/academic-integrity-code.pdf.

Please note that it is my professional obligation and responsibility to report any academic misconduct to the Dean of Students Office. **Any student found in violation of the code by cheating, plagiarizing or using any online software inappropriately will result in disciplinary action. This may include a failing grade of F, and/or suspension or dismissal from the university.** If you have any questions about the code of Academic Integrity, please contact the Dean of Students Office at dos@njit.edu"

Weekly Schedule – to the extent possible:

Week	Topics	Chapter	Homework Problems
1	Introduction, Stability and Classification of Structural Behavior & Analysis	1, 2	To be assigned
2	Analysis of Simple and Compound Beams including Shear and Moment Diagrams	2, 4	
3	Analysis of Simple Frames including Shear and Moment Diagrams	4	
4, 5	Influence lines, Moving Loads, Shear and Moment Envelops	6	
6	Review, Test I		
7	Introduction to Approximate Analysis of Structures	12	Term Project Assigned
8, 9	Deflections: Diagram and Elastic Curve, Moment area, and integration methods	7	
10	Deflection of Trusses: Virtual Work Method (Unit Load Method)	3, 8	
11	Review, Test II		
12	Indeterminate Structures: Consistent Deformation Method	9	
13	Indeterminate Structures: Slope Deflection Method	10	
14	Review, Test III		
15	FINAL EXAM		

Course Modules / Topics

I expect you to learn and demonstrate mastery in the following topics/modules:

1. Find reactions and draw shear and moment diagrams for simple and compounded beams (beams with hinges)
    - You must know simple beam analysis – covered in statics and strength of materials
2. Find reactions and draw shear and moment diagrams for simple frames – with and without hinge(s).
3. Understand the concept of influence lines, draw it for basic beam, and use it to determine maxima as asked – maximum shear or moment for beams.
4. Perform approximate analysis (hand solution) of frames and use a software to analyze the same
5. Determine deflection of beams using double integration method
6. Determine deflection of beams using moment area method
7. Determine deflection of trusses using unit load method (energy method)
    - You must know truss analysis – covered in statics and strength of material
8. Analyze and draw shear and moment diagrams for continuous indeterminate beams

Make sure you review your statics and strength of materials notes. Make sure you always draw free-body-diagram when solving structural analysis problems.

Course Grade

	Assessment Opportunities				
	Classwork	Test I	Test II	Test III	Final
Modules 1 through 3	☒	☒	☒	☒	☒
Modules 4 through 6	☒	☐	☒	☒	☒
Modules 7 and 8	☒	☐	☐	☒	☒
Course grade is based on sum of modules grade. Each Module will have 11-points. For a total of 88 points. You must demonstrate your mastery on all modules (i.e. score 60% or better). However, if overall score is higher than 60 then two modules can have a score lower than 60 but not less than 30.					
Computer Project – 7 points					
Homework – 5 points					

- The <u>minimum</u> requirements for final letter grades are as follows:
  A = 90.0%, B+ = 85.0%, B = 80.0%, C+ = 75.0%, C = 70.0%, D = 60.0%, F < 60.0%
- The NJIT Honor Code will be upheld, and any violations will be brought to the immediate attention of the Dean of Students.

General Information

Students will be notified well in advance, should there be any modifications or deviations from the syllabus throughout the course of the semester.

Communication: Communication by the Instructor will be done in person during class and/or through Canvas. It is your responsibility to check with a classmate if you missed a class and check e-mail, and the course page on Canvas regularly.

Lectures/Class: This is a face-to-face class, except for first two weeks. Please be attentive, participate in discussions, and ask questions at any time. Please turn all cell phones off during class and be respectful to the course instructor and your classmates.

The instructor will assign homework problems and the project. In addition, the students are encouraged to solve many additional problems in the textbook and use many other resources available online. During the term, each student is required to complete the following requirements in addition to the requirements previously mentioned.

1. Use of a software of your choice to perform basic analysis.
   a. An intro to Robot will be provided.
      i. This is an analysis and design module within Rivet.
      ii. Download for free from Autodesk, or
      iii. Access department's remotely

b. This is a free and easy one: https://structural-analyser.com/ with a tutorial by an ex-student https://mediaspace.njit.edu/media/Structural+Analysis+Project/1_r1gwoxb7, or
c. Use any program of your choice.

Useful Links: Mastery of subjects in statics and basic algebra and geometry is critical to the success in this course. If for any reason you are "rusted" with these subjects, please start to remedy the shortcomings immediately. You are welcome to see me and/or your TA for help. You should also utilize online resources. There are many great sources online and share with me anything that you find helpful. The following are some useful links. I specifically recommend the free course on statics for those who think they need to do a good review:

https://www.coursera.org/learn/engineering-mechanics-statics Statics – free online

https://www.khanacademy.org   For every student, every classroom, real results!

https://www.coursera.org/learn/mastering-statics   Mastering Statics

https://www.coursera.org/learn/engineering-mechanics-statics-2 Applications in Engineering Mechanics

https://www.coursera.org/learn/beam-bending   Mechanics of Materials III: Beam Bending

https://www.coursera.org/learn/mechanics-1   Mechanics of Materials I: Fundamentals of Stress & Strain and Axial Loading

Outcomes Course Matrix – CE 332 Structural Analysis

Strategies, Actions and Assignments	ABET Student Outcomes (1-7)	Program Educational Objectives	Assessment Measures
Student Learning Outcome 1: Provide the ability to understand the behavior of structures under different loading conditions.			
Illustrate basic structural applications and static analysis.	1	1	Weekly homework and quizzes.
Discuss the design of structures.	1	1, 2	Weekly homework and quizzes.
Student Learning Outcome 2: Apply the principles and equations for the analysis of statically determinate and indeterminate analysis in preparation for subsequent design courses.			
Develop various methods of analysis.	1	1, 2	Weekly homework and quizzes.
Provide distinct and detailed examples of how these methods are utilized.	1, 2	1, 2	Weekly homework and quizzes.
Student Learning Outcome 3: Use structural analysis/design software.			
Discuss software tools.	3	1	Lab report.
Analyze assignments using software tools.	1, 7	1	Review of analysis problems.

CEE Mission, Program Educational Objectives and Student Outcomes

The mission of the Department of Civil and Environmental Engineering is:
- to educate a diverse student body to be employed in the engineering profession
- to encourage research and scholarship among our faculty and students
- to promote service to the engineering profession and society
  Our program educational objectives are reflected in the achievements of our recent alumni:

  1 – Engineering Practice: Alumni will successfully engage in the practice of civil engineering within industry, government, and private practice, working toward sustainable solutions in a wide array of technical specialties including construction, environmental, geotechnical, structural, transportation, and water resources.

2 – Professional Growth: Alumni will advance their skills through professional growth and development activities such as graduate study in engineering, research and development, professional registration and continuing education; some graduates will transition into other professional fields such as business and law through further education.

3 – Service: Alumni will perform service to society and the engineering profession through membership and participation in professional societies, government, educational institutions, civic organizations, charitable giving and other humanitarian endeavors.

Our Student Outcomes are what students are expected to know and be able to do by the time of their graduation:

1. an ability to identify, formulate and solve complex engineering problems by applying principles of engineering, science and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety and welfare, as well as global, cultural, social, environmental and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data and use engineering judgment to draw conclusions

7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

Revised: 10/8/2019