New Jersey Institute of Technology
Digital Commons @ NJIT

Civil and Environmental Engineering Syllabi | NJIT Syllabi

Spring 2021

CE 333-002: Reinforced Concrete Design

Mohamad Saadeghvaziri

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

Recommended Citation
Saadeghvaziri, Mohamad, "CE 333-002: Reinforced Concrete Design" (2021). *Civil and Environmental Engineering Syllabi*. 558.
https://digitalcommons.njit.edu/ce-syllabi/558

This Syllabus is brought to you for free and open access by the NJIT Syllabi at Digital Commons @ NJIT. It has been accepted for inclusion in Civil and Environmental Engineering Syllabi by an authorized administrator of Digital Commons @ NJIT. For more information, please contact digitalcommons@njit.edu.

DEPATMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

CE 333 - Reinforced Concrete Design	Spring 2021
Texts:	Design of Reinforced Concrete 10th Edition By: Jack C. McCormac and Russell H. Brown ISBN: 1118879108 ACI Committee 318 (2014), *Building Code Requirements for Structural Concrete and Commentary (318-14).* Farmington Hills, MI: American Concrete Institute. ACI 318-14 can be purchased from the American Concrete Institute at a reduced rate available only to students. Please visit the website below to register as a student. Once you register, you can purchase ACI 318-14 at the ACI bookstore for a reduced rate. Registration: www.concrete.org/membership/studentmembership.aspx Store: www.concrete.org/store.aspx
Instructor:	Dr. M. Ala Saadeghvaziri, Room 216 Colton Hall, Tel: 973-596-5813, ala@njit.edu ; Office hours: Mondays 11:00AM – 2:00PM; other times by appointment. Please do not be shy; see me (for now virtually) if you need help.

Prerequisites: *CE 332 and CE 260. The student must have a working knowledge of structural analysis including determinate and indeterminate beams and frames. Primary objectives include the following: to acquaint the student with the properties of concrete and steel and with the behavior of reinforced concrete as a structural material; also to develop methods for the design of reinforced concrete structural members such as beams, slabs, footings, and columns. Both ultimate strength design and working stress method will be studied.*

Academic Integrity

"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"

In light of the nature of online tests, you might be asked to meet the instructor and explain your solutions. It is at the discretion of the instructors who will be asked to further explain tests' solutions.

Weekly Schedule – to the extent possible:

Week	Topics	Chapter	Homework Problems
1	Introduction, Review Composite Sections, Compatibility, Material Properties, ACI Design Philosophy, Various Loads & Load Combinations	1	Assigned in class.
2	Flexural Analysis of Beams: Un-cracked, Cracked, Ultimate Conditions	2	
3	(Ultimate) Strength Analysis Based on ACI	3	
4, 5	Design of Rectangular Beams and One-way Slabs	4	
Exam 1			
6, 7	Analysis & Design of T-Beams and Doubly Reinforced Beams	5	
8	Shear Design (Strength Method) in Beams	8	
9	Continuous Beams, ACI Coefficients, Design for Negative Moment	14	Term Project Assigned
Exam 2			
10	Serviceability	6	
11	Bond Development Length, and Splices/Cutoffs	7	
12	Short Columns Analysis & Design	9, 10	
13	Strength Method for Footing Design	12	
Exam 3			
14	Review(s) and time for Exams		
15	FINAL EXAM		

Course Objectives / Modules

By the end of this course, the student will be able to:

1. **General Design:** Describe and understand material behavior at various stages of loading; explain fundamental behavior of concrete sections and principles behind code provisions used.
2. **Flexural and Shear Analysis/Behvior and Design:** Explain the behavior of a reinforced concrete section at various levels of loading; calculate the nominal bending strength of a reinforced concrete member with and without compression reinforcement; design a reinforced concrete flexural member with economy and constructability in mind; discuss how shear forces are transferred through a reinforced concrete component; design a reinforced concrete member to resist shear forces.
3. **Slab Analysis/Behavior and Design:** Describe load transfer mechanisms in one-way slabs; design a one- way slab for flexure, shear, temperature, and shrinkage requirements.
4. **Development and Serviceability:** Explain the importance of development length as it relates to reinforced concrete member behavior; perform necessary calculations to design a member's development length, bar splices, and bar cutoffs; describe cracking behavior in reinforced concrete members; calculate deflections in a reinforced concrete member.
5. **Short Column Analysis/Behavior and Design:** Explain the difference between short and slender columns; identify the types of transverse reinforcement used in columns and reasons for using them; calculate the capacity of a short reinforced concrete column.
6. **Footing Analysis/Behavior and Design:** Describe limit states used in design of footings; calculate the reinforcement requirements for strip and spread footings.

Course Grade

A weighted average grade will be calculated as follows:

Homework	10%
Project	10%
3-Exam Average	55%
Final Exam	25%

No makeup will be given. Under legitimate, documented and extenuating circumstances the grade for the final exam will be used for missed assessment(s).

The minimum 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%

Additional Information:

Communication: All communication by the Instructor will be done through Canvas. It is your responsibility to check e-mail, and the course page on Canvas regularly.

Lectures/Class: This is a converged online course, defined, as "Delivery of instruction is independent of place, merging the physical and virtual classrooms. There is an attendance expectation and students can choose to attend class face-to-face or using real-time synchronous

video conferencing technology. Some instructors may require occasional proctored exams. (sometimes referred to as a synchronous distributed course)."

Please turn all cell phones off during class and be respectful to the course instructor and your classmates.

Prerequisites: As noted it is CE 332 & CE 260, It is assumed that you have a background in structural analysis, mechanics of materials, and statics. These three areas represent the foundation of reinforced concrete behavior and design. For example, if you are asked to design a reinforced concrete member you are expected to know how to calculate the shear force, or moment under a given set of loads. You will not necessarily be given every piece of information you need to solve a problem, but enough to be able to solve it with some looking up of expressions or conducting analyses.

Exams: There will be three exams during the semester plus a cumulative final exam. They will be through Canvas and you need to be well versed to upload your work promptly. You must your camera on and it must be positioned such that your face and work area is clearly visible.

Homework: Homework will be assigned to encourage further reading, to extend the material presented in lectures, and to provide practice in arriving at engineering solutions to problems. Completion of the homework is an essential part of the learning process. All homework is to be turned in individually unless specified otherwise on the assignment. If you collaborate with a classmate be sure to state that collaboration and their names at the top of your assignment.

Homework Format: It is expected that all homework be presented in an organized manner; use engineering paper if possible, one side of each page (clear side, not grid side); begin each problem on a new page and number all pages; have your name written clearly on the front page. All homework will be collected and graded. Upload ONE pdf file on Canvas. Presentation will account for 33% of the grade.

Late Homework: Homework will be due at the beginning of class on the date it is due. Late Homework will be accepted up to 72 hours after the due date with a 30-point penalty on the grade. After 72 hours, submissions will not be accepted.

Homework will be submitted through **www.gradescope.com**. It is an easy platform to submit homework, and the grader will help you if you have any problems. Email Jin at: jf372@njit.edu with any questions. It MUST be one file and in **PDF format**.

Legal Disclaimer: Students' ability to meet outcomes listed may vary, regardless of grade. They will achieve all outcomes if they attend class regularly, complete all assignments with a high degree of accuracy, and participate regularly in class discussions. This syllabus is subject to change at the discretion of the instructor throughout the term. However, students will be notified well in advance, should there be any modifications or deviations from the syllabus throughout the course of the semester.

CEE Mission, Program 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

As the CEE Department moves into the 21st century, we will continue to build upon our role as an important educator of civil engineers and environmental engineers in the State of New Jersey. Our main vision for the future is continuous quality improvement of students and faculty as NJIT advances in stature both regionally and nationally. Education of bachelor-level civil engineers remains a principal focus of the CEE Department, and to this end, we have established program educational objectives and student outcomes.

Program Educational Objectives

Our program educational objectives are reflected in the achievements of our recent alumni.

1. *Engineering Practice:* Recent 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:* Recent alumni will advance their skills through professional growth and development activities such as graduate study in engineering, professional registration, and continuing education; some graduates transition into other professional fields such as business and law through further education.
3. *Service:* Recent alumni perform service to society and the engineering profession through membership and participation in professional societies, government, educational institutions, civic organizations, and humanitarian endeavors.

Student Outcomes

Our BSCE student outcomes are what students are expected to know and be able to do by the time of their graduation:

a. ability to apply knowledge of mathematics, science, and engineering
b. ability to design and conduct experiments, as well as to analyze and interpret data
c. ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
d. an ability to function multi-disciplinary teams
e. an ability to identify, formulate, and solve engineering problems
f. an understanding of professional and ethical responsibility
g. an ability to communicate effectively
h. the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
i. a recognition of need for, and an ability to engage in life-long learning
j. a knowledge of contemporary issues

k. an ability to use techniques, skills, and modern engineering tools necessary for engineering practice

Course Objectives Matrix – CE 333 Reinforced Concrete Design

Strategies and Actions	Student Learning Outcomes	Outcomes (a-l)	Prog. Object.	Assessment Methods/Metrics
Course Objective 1: Illustrate and develop the design methodologies, and introduce and employ the concept of codes and specifications for design of reinforced concrete members and elementary structures.				
Illustrate ultimate strength and allowable stress design philosophies.	Learn design concepts and modes of failure.	a, c	1, 2	Homework, projects, quizzes, and exams.
Formulate the ultimate strength design methodology.	Learn the relationship between theoretical concepts and design procedures.	a, c, e	1	Homework, Projects, quizzes, and exams.
Discuss the ACI design codes.	Gain professional knowledge required to design safe, serviceable and economical members.	a, c, e, f	1, 2, 3	Homework, Projects, quizzes, and exams.
Course Objective 2: Apply and enhance knowledge of strength of materials and structural analysis.				
Incorporate and apply basic knowledge of strength of materials.	Learn the concept of composite sections based on the characteristics of constituent materials.	a, c, e	1	Homework, quizzes, and final exam.
Incorporate and apply basic knowledge of structural analysis.	Apply knowledge of shear and moment diagrams and influence lines.	a, c, e	1	Homework, quizzes, and final Exam.
Course Objective 3: Incorporate proper use of modern engineering tools for problem solving and communication.				
Introduce state of the art analysis and design software (such as Rivet/Robot, STAAD/Pro, SAP2000 etc.).	Learn how to use the latest technology in solving structural analysis and design problems.	**k**	1, 2	Homework and projects that are solved using STAAD/Pro.
Discuss the pitfalls of computerized analysis and design and the need for sound engineering judgement.	Learn how to use modern technology properly and effectively.	**k**	1, 2	Homework and projects are solved both manually and by STAAD/Pro.
Place some assignments and course syllabus on the internet. Use e-mail for communications.	Learn how to use information technology.	**k**	1	None.
Course Objective 4: Develop decision making skills and provide an environment for independent thinking while encouraging effective teamwork.				
Demonstrate non uniqueness of design solutions.	Learn how to make design decisions considering realistic constraints such as safety, economy and serviceable.	c, e	1, 2	Design problems.
Require independent work on homework and projects, and all quizzes and exams.	Learn how to plan and organize work and enhance problem solving skills.	a, e	1, 2	Homework, projects, quizzes, And final exam.

Require teamwork for some assignments.	Learn the importance of coordination and time management.	d, f, g	1, 2	Homework and Projects.