JOHN A. REIF, JR. DEPARTMENT OF
CIVIL AND ENVIRONMENTAL ENGINEERING
NJIT New Jersey Institute of Technology

CEE 333 – 101: Reinforced Concrete Design

(2 credits – 3 contact hours)

Lectures Friday(s) 6:00 pm – 8:50 pm
CKB 219

Instructor **James Ingemi, PE, SE** Office Hours: Online by appointment
JTI3@njit.edu
(978) 578-8138

Prerequisite CE 332 – The student must have a working knowledge of structural analysis including determinate and indeterminate beams and frames.

Required Textbook

Design of Reinforced Concrete 10th Edition.
By Jack C. McCormac and Russel H. Brown
ISBN: 1118879108

Other Recommended Texts & Reading

ACI Committee 318 (2019), *Building Code Requirements for Structural Concrete and Commentary (ACI 318-19)*. Farmington Hills, MI: American Concrete Institute.

ACI 318-19 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 318-19 at the ACI bookstore for a reduced rate.
Registration:
www.concrete.org/getinvolved/membership/studentsmembership.aspx
Store: www.concrete.org/store.aspx

Course Description *(from NJIT's course catalog)*

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.

Course Objectives (General)
By the end of this course, the student will be able to:

General Design: Compare and contrast different methods used for the design of structural concrete; describe the influence of concrete materials on concrete design; explain fundamental behavior of structural concrete and principles behind select code provisions.

Flexural and Shear Behavior and Design: Explain the behavior of a reinforced concrete section at various levels of deformation; 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.

Slab Behavior and Design: Describe load transfer mechanisms in one-way slabs; design a one-way slab for flexure, shear, temperature and shrinkage requirements.

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.

Short Column 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 short reinforced concrete columns.

Footing Behavior and Design: Describe limit states used in design of footings; calculate the reinforcement requirements for strip and spread footings.

POLICIES & PROCEDURES

Academic Integrity: It is expected that NJIT's University Code on Academic Integrity will be followed in all matters related to this course. Refer to NJIT's Dean of Students website to become familiar with the Code on Academic Integrity and how to avoid Code violations.

https://www.njit.edu/policies/sites/policies/files/academic-integrity-code.pdf

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: Attendance at all lecture/class periods is expected. Students are expected to participate through the class period. During class, I will often ask you to work on a problem or brainstorm ideas and you will then be called on to provide one or more of your answers. The goal of

this in-class work will be to get you started on a problem (not necessarily finish) that we will then discuss. Please be respectful to the course instructor and your classmates. You should always bring a pencil and calculator with you to class.

Handouts: Copies of the notes used in class will be posted on Canvas throughout the semester at least one day before lecture. It is highly recommended that you print out a set of notes to follow along with during lecture, as notes will be filled in on these handouts. A "filled-in" version of these notes will be posted after class.

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 his/her name at the top of your assignment.

Homework Format: It is expected that all homework be presented in an organized manner; use engineering paper only, 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.

Late Homework: Homework will be due at the beginning of class on the date it is due. Late Homework will not be accepted.

Homework Solutions: Homework solutions will be posted three days after the homework is due. It is your responsibility to make sure you understand how to solve the problems by attending office hours with the instructor and/or asking questions in class. As with many engineering problems, many solutions may be possible and will be accepted if they follow logical engineering judgement.

Exams: There will be three exams during the semester plus a cumulative final exam. Students will be permitted to bring one-page of reference material/notes (one-side only, letter sized paper).

Calculation of Course Grade: A weighted average grade will be calculated as follows:

Homework	10%
2-Exam Average	55%
Projects/Participation	10%
Final Exam	25%

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%

Note: Grades are not curved. It is theoretically possible for everyone in the class to get an A (or an F). Your performance depends only on how you do and how much you learn, not on how everyone else in the class does. It is therefore in your best interest to help your classmates, while acting within the bounds of the stated academic integrity policy (i.e., NJIT's Code of Academic Integrity).

Instructor Commitment: You can expect the instructor to be courteous, punctual, organized, and prepared for lecture and other class activities; to answer questions clearly; to be available during office hours or to notify you beforehand if office hours are moved; to provide a suitable guest lecturer

or pre-recorded lecture when they are traveling or unavailable; and to grade uniformly and consistently.

AI statement: The use of artificial intelligence (AI) is permitted in this course only when explicitly stated in assignments. If students use AI for any course-related work, they must cite it according to the guidelines provided on the **NJIT Library AI Citation page**. If you have any questions about AI use in this course, please contact the course instructor before submitting any assignments. In cases where AI use is not allowed, students are expected to complete work without AI assistance to develop their skills in this subject area.

Students with Documented Disabilities: NJIT is committed to providing students with documented disabilities equal access to programs and activities. If you have, or believe that you may have, a physical, medical, psychological, or learning disability that may require accommodations, please contact the Coordinator of Student Disability Services located in the Center for Counseling and Psychological Services, in Campbell Hall, Room 205, (973) 596-3414. Further information on disability services related to the self-identification, documentation and accommodation processes can be found on the webpage at: (http://www.njit.edu/counseling/services/disabilities.php)

Course Schedule: See below for preliminary schedule including estimated exam dates, course topics, project dates, etc.

WEEK	DATE	LECTURE TOPIC
1	September 5, 2025	Introduction, Design Philosophy (Service vs. Strength), Material Properties
2	September 12, 2025	Design Loads, Flexural Behavior of Reinforced Concrete Beams
3	September 19, 2025	Flexural Strength Analysis of Reinforced Concrete Beams
4	September 26, 2025	Design of Rectangular Beams & T-Beams
5	October 3, 2025	Doubly Reinforced Beams, Serviceability, Development Length, Splices
6	**October 10, 2025**	**EXAM #1**
7	October 17, 2025	Shear and Diagonal Tension
8	October 24, 2025	Design of One-Way Slabs
9	October 31, 2025	Introduction to Columns, Design of Short Columns Subjected to Axial Load
10	November 7, 2025	Design of Short Columns Subjected to Axial Load and Bending
11	**November 14, 2025**	**EXAM #2**
12	November 21, 2025	Foundation Design
13	*November 28, 2025*	*THANKSGIVING BREAK - NO CLASS*
14	December 5, 2025	Structural Systems in Reinforced Concrete Buildings & Bridges
15	December 12, 2025	Constructability (Shoring & Re-Shoring) + Review
16	**December 19, 2025**	**FINAL EXAM**

Course Objectives Matrix – CEE 333 – 101

Strategies and Actions	Course Student Learning Outcomes	**Student Outcomes (1-7)**	Program Educational Objectives	Assessment Methods/Metrics
Course Objective 1: Apply design methodologies, codes and specifications to the design of reinforced concrete members and elementary structures.				
Illustrate ultimate strength and allowable stress design philosophies.	Students shall be familiar with both design philosophies and understand the applicability, limitations, etc. of each said philosophy.	1, 2	1, 2	Homework, projects, quizzes, exams
Formulate the ultimate strength design methodology.	Students will be able to generate and derive governing principal equations for strength design.	1, 2	1	Homework, projects, quizzes, exams
Discuss the ACI design codes.	Students will become familiar with the ACI design manual along with references/codes.	1, 2, 4	1, 2, 3	Homework, projects, quizzes, exams
Course Objective 2: Apply and enhance knowledge of strength of materials				
Incorporate and apply basic knowledge of strength of materials	Students shall be able to apply working knowledge from other pre-requisite courses to concrete design.	1, 2	1	Homework, projects, quizzes, exams
Incorporate basic knowledge of structural analysis	Students will deploy structural analysis skills from pre-requisite courses to evaluate typical structural elements.	1, 2	1	Homework, projects, quizzes, exams
Course Objective 3: Incorporate proper use of modern engineering tools for problem solving and communication.				
Introducing design software (such as STAAD, Enercalc)	Familiarize the student with engineering software that is typically used in the professional engineering environment.	7	1, 2	In class workshop problems and homework
Discuss the pitfalls of computerized analysis and design and the need for sound engineering judgement.	Students will become familiar with how to verify computer results using both ASD and LRFD design methodologies.	7	1, 2	Some workshop problems will be solved by hand and via software.
Place some assignments and course syllabus on the internet. Use e-mail for communications.	Students will be responsible for coordinating electronically.	7	1, 2	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.	Students will follow worked out in class examples of how engineering textbook problems can be solved multiple ways and how engineering judgement, constructability, etc. are incorporated.	1, 2, 4	1, 2	Design problems
Require independent work on homework, quizzes and exams.	Students will take accountability for their own independent learning and applied understanding of course materials.	1, 2	1, 2	Homework, quizzes and exams.
Require teamwork on in-class workshop type problems.	Students will collaborate with others to furnish economized solutions.	3, 5	1, 2	Homework and in-class workshop 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 scholarships among our faculty and students
- to promote service to the engineering profession and society

Program Educational Objectives

Our **Program Educational Objectives** are reflected in the achievements of our recent alumni:

1. **Engineering Practice:** Alumni will successfully engage in the ethical practice of civil engineering within industry, government, and private practice, working towards safe, practical, resilient and 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 technical and interpersonal 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 academia, 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.

Student Outcomes

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 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 conclusion
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies
Updated 8/2025