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Fall 2018

# CE 431-001: Construction Materials Laboratory

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JOHN A. REIF, JR. DEPARTMENT OF  
**CIVIL AND ENVIRONMENTAL  
 ENGINEERING**



**CE 431 – Construction Materials Laboratory  
 Section: 001**

**Fall 2018**

<b>Text:</b> No Text
<b>Instructor:</b> Professor Walter Konon, Room 223 Colton Hall, Phone#: 973-596-2476, <a href="mailto:konon@njit.edu">konon@njit.edu</a> , Office Hours: Wednesday 10-11:30 AM and Thursday 11:30-1 PM or by appointment
<b>Prerequisite:</b> Mech 237 with a grade of C or better, CE 210.

**Description:** This course provides an understanding of the basic properties of construction materials, and presents current field and laboratory standards and testing requirements for these materials. Students select a material or component assembly for testing, design a testing procedure, and present their results.

Week	Topic	Reference
1	Introduction, Safety, Lab Report Format	
2	Portland Cement Concrete (PCC) Mix Design	ACI 211
3	PCC Batch and Test Mix, Slump, Air Cylinder Preparation	ASTM C192, ASTM C31, ASTM C143, ASTM C231 ASTM C173 ASTM 172
4	Concrete Cylinder Testing (7 Day)	ASTM C39, ASTM C496, ASTM C805
5	Welding & Weld Testing	Handout
6	Welding and Weld Testing –Epoxy Sample Prep	ANSI/AWSP1.1
7	Concrete Cylinder Testing (28 day), Windsor Probe, Concrete Hammer, Ec, Indirect Tension	ASTM C31, ASTM C805 ASTM C803, ASTM C496, C469
8	Strain Gauges	Handout
9	Student Designed Lab-Topic, Research and Testing Proposal	
10	Asphalt Pavements; Epoxy Strength Testing-Tension, Shear	Handout
11	Student Designed Lab	
12	Construction Vibrations, Noise Measurement, Moisture, Light, Gas	Handout
13	Student Designed Lab	
14	Presentation of Results of Student Testing	

Note: Students will be consulted on any substantial changes to the course syllabus. Changes will be discussed and announced in advance.

**Basis of Grading:** Lab Reports = 60%, Final Project = 30%, Class Participation = 10%.

**Honor Code:** Students are advised that the NJIT Honor Code will be upheld in this course, and any violations will be brought to the immediate attention of the Dean of Students.

Lab Introduction:

**Welcome to the CEE Construction Materials Laboratory.** This is a place where you will “put to the test” the theory you are learning in the classroom. The Construction Materials Laboratory Course (CE 431) is designed to complement the lecture portions of four construction/structures oriented courses: Construction Methods and Procedures (CE 210), Construction Engineering (CE 414), Concrete Design (CE 333) and Steel Design (CE 432). The specific objectives of this course are to provide the student with an opportunity to:

1. Investigate the properties and behavior of materials and their assemblies;
2. Become familiar with ASTM specifications and testing procedures and with construction field monitoring and testing practices;
3. Develop skills for analyzing experimental data and working in teams;
4. Learn to design, conduct and analyze data of a custom student designed laboratory experiment.
5. Research and cite reference standards.

Most of the experiments are performed by student groups of four to five person. The experiments are interactive and involve: (1) setup; (2) operation; (3) measurement; (4) adjustment; (5) data gathering; and (6) data reduction. The group approach teaches the value of teamwork in problem solving during the laboratory period and after class as data are exchanged and reduced. Some experiments are performed as class demonstrations in which each group is assigned a single data set to analyze. Later, towards the end of the period, each group reports their results to form a collective body of data.

You will have the opportunity to design and conduct your own custom laboratory experiment. It will be both an interesting and challenging experience, since you must translate a stated problem into a physical experiment, research and cite standards, testing procedures and expected results, making decisions on set-up, experimental parameters, and analysis methods and report and present your finding. This experiment will require you to apply the various experimental techniques that you have learned throughout the semester.

Written assignments must be submitted for each laboratory experiment. Most lab reports will be written and submitted individually by the student. In completing individual report, students in the same group will share data, although all analyses and written text must be the student's own work. A few group-written reports will be assigned during the semester. For some experiments, an abbreviated lab format report will be submitted.

Your safety and the safety of those around you are of prime importance. Efforts have been made to reduce the hazard in the lab as much as possible. Students should follow the general safety rules included on the following page. If you should see anything that you consider to be a safety hazard report this condition to your lab instructor. If you have any questions about the safety of the lab you are going to conduct, consult the lab instructor. Take your experiments seriously. Forces into the thousands of pounds will be used throughout the course and if these forces are released in an uncontrolled manner injuries are possible.

Good luck with your experiments this semester, and work safe!

**Description:**

The course explores the principles of standardized and self-designed laboratory testing of the mechanical properties and response of civil engineering materials and assemblies. The laboratory is hands on, and its aim is to build confidence in using laboratory and field testing as a tool for the solution of physical engineering problems.

**Prerequisites:** Mech 237 with a grade of C or better, CE 210

**Textbook (s) Materials Required:** None (Class handouts)

**Course Objectives:**

1. Investigate the properties and behavior of materials and assemblies.
2. Become familiar with ASTM specifications and testing procedures and with construction field monitoring and testing practices.
3. Develop skills for analyzing experimental data and working in teams.
4. Design and conduct a custom laboratory experiment, analyze and interpret the data, and make a presentation on the results of the testing.
5. Research and cite reference standards.

**Topics:**

Orientation and Lab Safety

Concrete mix design -

ACI 211

Concrete mixing and testing – ASTM C192, C143, C231, C173,C138

Welding and weld inspection and testing

Glued connections – ASTM D897, D1002

Hardened concrete testing – ASTM C39, C469, C496, C78

Strain gages

Asphalt pavements gas, noise, light, vibrations, moisture-measurement and standards

Electronic Data Acquisition

Student Designed Lab

Student presentation of self-designed testing

Schedule: (0-3-1)

Professional Component: Engineering Topics, Standards

Program Objectives Addressed: 1,2

Prepared By: Prof. Konon

**Course Objectives Matrix – CE 431 Construction Materials Laboratory**

<b>Strategies, Actions and Assignments</b>	<b>ABET Student Outcomes (1-7)</b>	<b>Program Educational Objectives</b>	<b>Assessment Measures</b>
<b>Student Learning Outcome 1: Investigate the properties and behavior of engineering materials and assemblies</b>			
Conduct experiments that measure the physical properties of materials and assemblies	6	1	Class participation, lab reports
<b>Student Learning Outcome 2: Incorporate and use ASTM specifications and testing procedures in testing, reports and presentations.</b>			
Perform material testing and identification as per ASTM and ACI standards and procedures	6	1, 2	Class participation, Lab reports
<b>Student Learning Outcome 3: Develop skills for analyzing experimental data and working in teams.</b>			
Conduct fully interactive physical testing	5, 6	1	Class participation, Lab reports
Perform experiments in students groups that require exchange and analysis of data during the laboratory period, as well as after class	5, 6	1, 2	Class participation, lab reports
Prepare written laboratory reports	3	1, 2	Lab reports
<b>Student Learning Outcome 4: Design and conduct a custom laboratory experiment, analyze and interpret the data, and make a presentation on the results of the testing.</b>			
Students identify a unique laboratory testing topic, design and conduct their own experiment, analyze the results and present their findings.	3, 5, 6	1, 2	Class participation lab report, oral presentation

## 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: 2/13/18