Syllabus – Fall 2023
CE 703: Concrete Durability
John A. Reif, Jr. Department of Civil and Environmental Engineering
V 1.0

Course Information

Title: CE 703: Concrete Durability
Class Location:
Meeting Time: Wednesday 6-8:50 P.M.
Credit Hours: 3 Credits

Instructor

Matthew P. Adams, Ph.D., FACI
Office: Colton 237
E-mail: adams@njit.edu
I respond to course e-mails once a day, and do not check e-mails on holidays, Saturday, or Sunday.

Office Hours

Thursdays: 2:00 – 5:00 PM

I am also available to meet via Zoom meeting online, by appointment. Email me to request one.

Course Description

This course will cover the design and maintenance of concrete structures and pavements from a material choice point of view. Students will learn how to design concrete mixtures, choose alternative and sustainable materials for use with concrete, produce concrete specifications, protect concrete from long-term deterioration, and design solutions for repairing existing concrete infrastructure. Students will also learn about concrete durability modelling and mechanisms of deterioration in concrete. The following key topics will be covered: Cement production, supplementary cementitious materials, mixture design and proportioning, concrete durability, freeze-thaw attack, sulfate attack, corrosion, alkali-silica reaction, long-term performance, durability prediction and modeling, durability of alternative cement, multi-scale assessment, dimensional stability, concrete specifications, and concrete construction.

Learning Outcomes

Upon completion of this course, students will be able to:

1. Describe the cement production process for a variety of hydraulic cement types.
2. Explain the hydration reactions in cement-based systems and apply this knowledge to property development and performance of hardened concrete.
3. Analyze microstructural development in concrete and how it influences macroscale behavior.
4. Describe the chemical or physical process of a variety of concrete durability concerns, how to identify them, and methods for preventing and remediating them.
5. Design concrete mixtures to ensure adequate early-age properties and long-term durability performance for a variety of exposure conditions.
6. Demonstrate improved technical writing and presentation skills through individual and group assignments.

Course Website

Information about the course, as well as many of the assignments and project guidelines will be posted on the course website. This can be accessed through canvas.njit.edu

Required Reading Materials

Throughout the term you will be tasked with reading peer-reviewed journal articles in preparation for class. These will be posted on Canvas.

Suggested Reading Materials

P.K. Mehta and P.J.M. Monteiro, Concrete: Microstructure, Properties and Materials, 4th Edition, McGraw-Hill, 2013; ISBN-13: 978-0071797870; ISBN-10: 0071797874
Note: This book is available for free to NJIT students this term via AccessEngineering. For more information see: https://researchguides.njit.edu/access-engineering

-AND-

ACI Committee 211.91: Standard Practice for Selecting Proportions for Normal Heavyweight and Mass Concrete. (Reapproved in 2009). This resource is available for free through a Free student membership from the American Concrete Institute. Directions for signing up for an ACI membership can be found at https://www.concrete.org/membership/studentmembership.aspx. Once you have signed up, you can navigate to the to the page for the ACI 211 standard practice and download it as a PDF.

-AND-

-Other Recommended Texts-

Gibaldi, J., MLA Handbook for Writers of Research Papers, 7th Edition, Modern Language Association, New York, New York, March 2009.

-or-

University of Chicago Press Staff, The Chicago Manual of Style, 15th Edition (or newer), University of Chicago Press, Chicago, Illinois, August, 2003.

www.cement.org – The website of the Portland Cement Association
www.concrete.org – The website of the American Concrete Institute*
*Students qualify for free e-membership and can access ACI Materials and ACI Structures Journals online for free once they are a member

Hewlett, P.C., and M. Liska (Editors), Lea's Chemistry of Cement and Concrete, Butterworth-Heinemann, 2018

Kosmatka, S.H., and M. L. Wilson. Design and Control of Concrete Mixtures; 16th Edition, Portland Cement Association, Skokie, IL, 2016

Course Schedule

Note: Course schedule is tentative and may change throughout the term. The instructor will communicate any changes. Class time is provided for topics of particular interest to students,

or to provide additional instruction if class is running behind. Students wishing to suggest a special topic should speak with the instructor. The course schedule will be handed out separately.

Course Equipment Expectations

You are expected to have a working laptop, tablet, or smart device to participate in this course. If you do not have a one of these devices, please contact the Library to check one out for class.

Attendance and Participation Policy

Attendance will be monitored throughout the course. While attendance isn't strictly mandatory, not coming to class will impact your ability to perform well during the course. Students are expected to be on time for class, and to remain in class during the entire period. Chronic lateness or leaving of class for extended periods of time will result in poor performance and may result in missed in-class exercises or quizzes. Class participation is part of your grade (via in class exercises), and missing class regularly will affect your grade. Regular attendance in class will greatly increase your ability to perform well on the exams, final project, and class assignments. Participation includes: questions or discussion during class, participation in group projects, participation in class assignments, questions during office hours. If a student must miss class, they are advised to inform the professor as soon as possible.

Email Policy

Students are expected to check their emails daily for any course updates and information.

Emails to the professor must be professional. For information on writing a professional e-mail, please see: https://www.purdue.edu/advisors/students/professor.php

Emails that are not professional, polite, or do not request a specific action or ask a question may not be responded to by the professor.

Homework Assignment Requirements and Grading

Homework assignments will be posted on the course website regularly throughout the term. Homework will not be collected or graded. Solutions will be posted alongside the homework assignment. It is recommended that students complete the homework to support their learning. Comparing your answers to the answers on the solution will help you to understand the type and level of discussion that will be required during the exams.

Course Exams

Two exams will be given during the course of the term, one during the term and a final exam. Each exam will be out of 100 points. Exams will be oral exams and will be administered during individually scheduled face-to-face sessions. A week prior to the exam, 5 potential exam questions will be released to the class, and you will be given time to prepare.

Course exams will be online and administered via Zoom. You will be required to have your Webcam on during the exam and you will be required to speak, so you MUST have a working

webcam and microphone for the exam if you intend to take the exam online. If you do not have a computer with a webcam, you can use your phone or tablet. If you do not have these, you should contact the Library about checking out a device from them for the exam day.

Missed Exam Policy

Missed examinations will not be allowed to be made up without an excused absence from the Dean of Students. For more information on this process please see: https://www.njit.edu/dos/student-excusals

In-class Exercises

In-class exercises will be done during the course. At least 10 of these in-class exercises will be done throughout the term. Additional ones, if time permits, will be done and the lowest scores will be dropped to reflect that only 10 exercises will count towards your final grade.

Course Project

The course project will be an individual project that will span the entire semester. Time will be given during some class periods to meet with the professor and discuss the project. The course project will be discussed in detail separately from the syllabus. The course project will be worth a total of 200 points, broken down into several assignments and presentations.

Grade Determination

The course grade will be determined using the following point breakdown:

Midterm Exam	100 Points
Final Exam	100 Points
In Class Exercises	100 Points (10 Exercises, 10 Points a piece)
Class Project	200 points (Comprised of several individually graded deliverables)

All grades will be rounded to the nearest point. Letter grades will be determined using the following breakdown of grade percentage:

A =450 points and above
B+ = 435 Points and above
B = 400 Points and above
C+ = 385 Points and above
C = 350 Points and above
F = 349 Points or less

Plagiarism and Copying

Plagiarism and copying will *not* be tolerated in this course. While it is encouraged that you discuss and work together to enhance learning, direct copying of each-others answers is prohibited. Many assignments require written responses and each student is expected to write their own response.

Plagiarism is also not tolerated. Plagiarism is when you use someone else's words, ideas, assertions, data, or figures and do not acknowledge that you have done that (i.e. pass it off as your own original work). If you use the words, ideas, or even phrases from someone else or any published material you must:

1. Use quotation marks around the copied words or phrases AND cite the source; or
2. Paraphrase or summarize using your own words and phrases AND cite the source.

Any charts, graphs, data, images, or numerical information used from another source or published material must also be cited. If you are not familiar with citations please work with an NJIT librarian to learn more. This is all material that should have been covered in your first-year writing courses.

You can learn more about how to do citations properly from:
https://www.plagiarism.org/article/how-do-i-cite-sources
https://lib.trinity.edu/in-text-citation-and-notes/

You can contact the NJIT library: askalibrarian@njit.edu

Student assignments will be submitted via a plagiarism detection software. Any evidence of plagiarism, copying, or cheating during exams, or on quizzes will result in an immediate grade of zero for the assignment and will be reported to the dean of students. A second instance of this will result in a failing grade for the course.

Use of AI software to answer questions or write papers is strictly forbidden. Most available AI software uses outdated information, miss-cites research papers, and often answers things incorrectly. It is very easy, for a knowledgeable professional to discern when a student has used an AI tool to write a paper. And even if the professor does not catch the student, it is likely that the student will not perform well on the assignment if they use the tool to do the work. **Any evidence that AI software has been used to do any assignment will result in failure.**

Extra Credit

No extra credit will be offered for the course. The grading is designed to give students many chances to do well in the course. For more information why extra credit is not offered please review the following website:

https://www.math.uh.edu/~tomforde/NoExtraCredit.html

Students with 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)

Academic Dishonesty and Student Conduct

(Taken from the NJIT Academic Integrity Code linked below)

New Jersey Institute of Technology is an institution dedicated to the pursuit of knowledge through teaching and research. The university expects that its graduates will assume positions of leadership within their professions and communities. Within this context, the university strives to develop and maintain a high level of ethics and honesty among all members of its community.

Imperative to this goal is the commitment to truth and academic integrity. This commitment is confirmed in this NJIT University Code on Academic Integrity. The essential quality of this Code is that each student shall demonstrate honesty and integrity in the completion of all assignments and in the participation of the learning process. Adherence to the University Code on Academic Integrity promotes the level of integrity required within the university and professional communities and assures students that their work is being judged fairly with the work of others. For more information on the code of academic integrity please see: http://www.njit.edu/education/pdf/academic-integrity-code.pdf

Class Behavior

While the university is a place where the free exchange of ideas allows for debate and disagreement, all classroom behavior and discourse should reflect the values of respect and civility. Behaviors that are disruptive to the learning environment will not be tolerated and students will be asked to leave the classroom. This includes but is not limited to aggressive behavior, sleeping in class, disruptive behavior, use of electronic devices for activities not related to coursework, racist, sexist, ableist or homophobic language and inappropriate or crude language.

If any student would like to inform me that they use a particular pronoun, please tell the professor.

E-mail communication with the professor and each other is expected to be professional. Any e-mails received by the professor that are not professionally formatted and stated will not be answered. Examples of professional e-mail etiquette can be found at the following links:

http://www.wikihow.com/Write-a-Formal-Email
http://englishlive.ef.com/blog/write-perfect-professional-email-english-5-steps/
https://owl.english.purdue.edu/owl/resource/636/01/

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.

Tentative Date	Lecture Topic Number	Topic	Module Delivery Mode
6-Sep-23	0	Course Introduction and Syllabus Overview	Face-to-Face
	1	University Resources, Plagiarism, Citations, and Referencing	Face-to-Face
	2	History of Cement and Concrete	Face-to-Face
	3	Writing a Memo	Online
13-Sep-23	4	Project Overview	Face-to-Face
	5	Review of Concrete Mixture Design	Online
	6	Review of Concrete Materials	Online
	7	Production of Portland Cement	Face-to-Face
	8	Types and Properties of Hydraulic Cements	Face-to-Face
20-Sep-23	9	Supplementary Cementitious Materials	Face-to-Face
	10	Chemical Admixtures	Online
	11	Reinforcement and Fibers for Concrete	Face-to-Face
	12	Reading peer-reviewed journal papers, writing annotated bibliographies, and turning that into a synthesis report.	Online
27-Sep-23	13	Review of Fresh and Hardened Properties of Concrete	Online
	14	Concrete Sustainability: Impacts, Solutions Policy, Codes, and Specifications	Face-to-Face
		Project Discussion and Meeting Time	
4-Oct-23	15	Cement Hydration	Face-to-Face
and	16	Curing of Concrete Elements	Face-to-Face
11-Oct-23	-	Project Discussion and Meeting Time	
18-Oct-23	17	Transport and pemeability in hardened cement paste and concrete	Face-to-Face
	-	Project Discussion and Meeting Time	
25-Oct-23	18	Dimensional Stability of Concrete: Drying Shrinkage, Plastic Shrinkage, Autogenous Shrinkage, and Differential Volume Change	
	19	Freeze/Thaw Damage and Salt Scaling	Face-to-Face
1-Nov-23	-	Midterm Exam - NO IN PERSON CLASS	Online
8-Nov-23	20	Aggregate Reactions in Concrete: ACR, ASR, and Iron Sulfide Attack	Face-to-Face
	-	Project Discussion and Meeting Time	
13-Nov-23	-	Last Day to Withdraw	
15-Nov-23	21	Sulfate Attack	Face-to-Face
	-	Project Presentation Requirements, Preview Discussion Time	
29-Nov-23	20	Corrosion: Chloride Ingress and Carbonation	Face-to-Face
6-Dec-23	21	Other Types of Concrete Deterioration	Face-to-Face
	-	Projet Discussion and Meeting Time	
13-Dec-23	22	Final Presentations	Face-to-Face
TBD	-	Final Exam	In Person